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Aviation and The Feminine Touch

Maintenance and Operating Equipment of Airplane and Seaplane Stations

Flying Between Canada and the United States

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AVIATION PAYS ITS WAY

A noteworthy article by Conway W. Cooke, showing clearly how other industries are benefitting through aeronautic research and development.

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Only from the air can this extraordinary detailed geometric planning he seen. Grouped about the Capitol may he seen in the front the Grant Memorial; on the extreme right part of the Representatives' Office Building; the Congressional Library, and at the left the Senate Office Building. The Capitol itself is one of the finest examples of halanced architectural planning in the world.

Aviation and the Feminine Touch

By Otto Praeger

Formerly Assistant Postmaster in Charge of the Air Mail

DOES not the whole development of commerce from the very beginning down to this day of palatial steamers, fast trains, luxurious automobiles, and speeding aircraft owe its genesis to the needs or demands of women? This carrying to and fro of silks, laces, and other choice products of the loom; of rare spices, perfumes, and feathers; of silver, gold, and diamonds and the thousand and one luxuries of the boudoir is inspired by women. Mere man would be satisfied to go fishing, letting everything run by the board except, perhaps, the silver, gold and diamonds.

Moreover, it is the same with foodstuffs and other necessities of life; they go to satisfy the demands of civilization which, in its modes and economics, bears the imprint of woman's imagination and management; and, because women are the same the world over, those things which appear for a period to be only luxuries for the wealthy and those in high places, soon become necessities for the common households of the land—if big sister has it, Cinderella will find a way! That which is good for the queen bee is good for the swarm; so we adopt the feminine whim into the family of virtues and are the gainers thereby.

In pre-historic times, say along about the cave-dwelling period, men dragged their wives around by the hair of their heads. After a time, however, they were obliged, due to the development of the "pug", to carry the women pick-a-back. Increases in the family, and an occasional case of obesity, in spite of the reputed strength of our forebears, made it too much of a hardship to continue this method of transportation, so, in self-defense, men tamed horses. From that time on, of course, the women either rode horseback, or were carried in some kind of cart. In the early stages of cart transportation, springs were unknown, and would be today if the women had been satisfied to bump around at the risk of a broken neck, even on the shortest journeys; but they were not—consequently the paved road and spring-fitted carriage came into existence, followed, in later time, by the railway coach and the ubiquitous automobile.

The automobile, while early promising a pleasant and comfortable method of conveyance, developed rather slowly following its inception, being mainly used by young men of sporting proclivities who dashed recklessly around the country in "red devils" and "yellow flyers". Women, casting a weather eye at this new method of transport, decided that automobiles generally were too greasy, lacked proper upholstery, and exposed the complexion to wind and

It is silly to think of any other mode of travel except by air, when searching for the intimate details of mountain ranges. Here is Mount Whitney and Seven Lake Region. So much terrain brought under the eye by trailing through the mountain wilderness would consume months of travel; while the region can be minutely studied in a day from the air.

weather in a measure not to be tolerated by any woman who was liable to be called upon any evening, at short notice, to bedeck herself and look her prettiest in order to advance the political or financial interests of her husband at some function arranged for the purpose. One or two manufacturers of automobiles, however, who were either students of feminine psychology, wise beyond their day, or gifted by a kind Providence with more brains than the average manufacturer, brought out the limousine.

This was the dawn of a new era in the automobile industry. Cars with beautiful lines, polished to an amazing degree, luxuriously upholstered with French whipcord or Arabian velour, with cradle-like springs and, in addition, provided in the left-hand inside corner of the tonneau with a cut-glass cornucopia capable of holding a five-dollar bunch of violets, interested the women greatly, whereupon they bought or induced their mates to buy automobiles by the million.

Aircraft manufacturers and operators must take a page from the book of the automobile industry if aircraft is to be made an economic factor in the life of this nation; if the industry is to be established on a grand scale, and if comfort, safety, and reliability are ever to be synonyms of the word, Aviation.

Women have merchandised and socialized the automobile. They will do the same for aircraft. Howbeit, women are not going to be interested in air navigation as long as they are obliged to walk through the mud of an improvised flying field, put on a heavy leather jacket, crush their best front and back hair out of place with a leather helmet, climb into a dinky little "1 x 3" seat, and have their spines nearly dislocated as the plane rushes across the field to take the air. For what do speed and beautiful scenery amount to when a woman's front and back hair is being crushed! The other side of the picture is the solution of the Aviation problem.

Well-turfed and lawn-like flying fields, setting off the beautiful lines of an air cruiser which has a luxuriously upholstered cabin, fitted with crystal observation windows, with comfortable arm chairs, foot rests, mirrors, and a cut-glass cornucopia capable of holding a five-dollar bunch of violets, and in which Milady, without fear of grease or leather helmets, or risk to front and back hair, may wear "nifty" sporting clothes, or an exquisite ball-room gown, spells nothing but *T R I U M P H*. Provide this sort of equipment and aircraft sales will rival those of the automobile.

Miss Jeanette Moffett in flying togs. The father of this charming enthusiast is Admiral William A. Moffett, Chief of the Navy's Bureau of Aeronautics; it appears that militant woman can and will do all her menfolks dare, otherwise we must state that Miss Jeanette is a "chip from the old block".

Proof that women are already influencing commercial aviation is available in the passenger lists of the regularly established air lines in Europe, such as London to Paris, London to Brussels, Paris to Antwerp, and others radiating from European Capitals. The same is true with reference to the passenger list of the largest airboat operating company in the world—right here in America. In fact, an overwhelming proportion of the passengers carried by all these lines, both in the United States and abroad, are women.

In London last summer two women, whose aggregate age was one hundred and seventy-six years, stepped into a cabined air cruiser at Croydon, London's air port, and, a few moments later, were whisked away to Paris. Returning to London next day they gave interviews picturing the delightful experience of flying between the two Capitals, over so much historic territory of such peculiar natural beauty—curiosity wins; age is nothing.

© Official U. S. Army Air Service
"The Hub" from the air. Boston—a queer jumhle of streets following the proverhial colonial cow-path, is a very interesting city from the air. The Custom House tower dominates the water-front section, and just below the steamhoats at East Boston Docks and close to the water-front may he seen the steeple of old North Church, famous in connection with the midnigbt ride of Paul Revere.

© Official U. S. Army Air Service
The historic "Huh", the Arc de Triomphe, Paris, centered at the Etoile, with the grand avenues radiating to distant vistas. Only from an airplane can this beautiful aspect of the Arc be realized.

There is something about flying which appeals strongly to women. I presume this is because women are particularly impressionable. Natural beauty generally, and the grandeur of mountain, lake and shore scenery in particular, has an exhilarating effect on the psycho-sensibilities of women. That this should be so is not to be wondered at. For instance; the world is full of Florence Nightingales. The battlefields of the Western Front have absorbed the dust of a great host of soldiers who died in the heat of battle. It has also absorbed the dust of many, many tenderhearted women who, after the excitement of battle was over, stood by and ministered to the wounded and the dying, and helped to bury those whose lives had been snuffed out. It takes the woman to fulfill a mission which requires a refined and chastened spirit and calls for calm courage. So, then, woman's mind quickly attains to the highest sensibilities of the race as we advance toward a complete and perfect civilization.

It holds true in flying. No woman can soar aloft until the great landmarks of the terrain are the only ties to the familiar scenes to which she is accustomed without sensing the immensity of space and the apparent narrow limits of our workaday world. Once high in the blue, her thoughts are released from the confining channels of household economy and the pressure of grinding care. Then it is that the aesthetic and broadening psychic influence imparted by flying grips her and quickens all her senses. That's why women are the most enthusiastic aerial passengers. Given a high type of equipment, with comfortable appointments, and women will do all of their touring by air.

In comparison with train or steamboat, aircraft win on speed alone. It is now a daily occurrence for London women to leave that city at 7.00 in the morning and, by air, arrive at Paris by 9.00. After spending a whole day shopping in that delightful city, or attending the races at Longchamps, Milady boards a returning airplane at 5.00 in the afternoon, and is dressed and ready to take her place as hostess at the usual 8.00 o'clock London dinner. She would have to endure seven and one-half hours of rail bumping and steamer-tossing in the steamboat-train-steamboat method of travel between the two cities. By this latter route, the trip is a two-day undertaking, and requires a third day if one really wishes to see Paris, or enjoy any of its activities.

Add to the convenience the exhilarating atmospheric conditions through which one flies, with rattle and dust and sea-sickness eradicated, with the scenic glories of two of the most historic and beautiful countries in Europe spread out before one's gaze as the plane wings along, and there can be no question about the desirability of touring by air, nor the fact that woman will demand it in greater and greater measure as time goes on.

Now let it be known that we have magnificent scenery in this country, and in such overwhelming measure that it may be reached within one or two hours by air from any of our great urban centers; and, further, remember that Great Britain and France are mere patches in comparison with the enormous extent of the United States. Consequently, in our land there are countless miles of air routes which may be laid out, which will bring a great convenience and, in addition, a great source of pleasure to women engaged in business, incidental shopping, or pure unadulterated touring by air.

It is reasonable to suppose that when aircraft manufacturers incorporate in their designs those features which the good taste and comfort of women demand, the whole industry will be materially benefited thereby, and we may expect a larger demand from the flying public for aircraft suited to passenger traffic.

Commercial aeronautics is gaining in volume from day to day, but the growth is slow. Such growth can be accelerated by giving attention to greater comfort in flying; consequently all future designs should, like that of the automobile, make aircraft particularly attractive to the feminine portion of the flying public which, according to the reports of aircraft operators, now comprises a large majority of all persons utilizing aircraft for travel and for sightseeing.

N. A. C. A. Compressed Air Wind Tunnel

First of Its Kind in the World - Operates in Greatest Compressed-Air Tank Yet Built

THE compressed air wind tunnel of the National Advisory Committee for Aeronautics has been completed and is in operation. On June 9, 1921, the Committee authorized the construction of this unique device, designed by Dr. Max Munk, technical assistant.

In short, the device consists of a 5-foot diameter wind tunnel of known type enclosed within a steel tank 15 feet in diameter and 34 feet long. This cylinder has been tested for an internal pressure of 450 lbs. per square inch, though the average working pressure will be 300 lbs. At one end is a large door, weighing two tons, opening inward. Along one side are glass windows placed at vantage points where may be viewed the recording instruments for the model placed in the test chamber. The interior of the tank is perfectly smooth, there being no interior bracing of any kind. The plates, 2¼ inches thick, are butted together and riveted to outside plates. The whole rests on a foundation of concrete. At the ends and along one side is an elevated platform. Provision is made for setting wing angles from without the cylinder.

The wind tunnel motor is of 300 h. p. and the Reynolds number is controlled by changing the air density rather than by changing the air speed. The air compressing units consist of two 300 h. p. compound compressors which compress the air to 115 lbs. per square inch. The air is compressed into a receiving chamber and then is again compressed by a 175 h. p. duplex booster compressor to the desired 300 lbs. in the test chamber. With these units it requires about one hour to fill the chamber with air at 300 lbs. pressure per square inch. Every provision has been made to avoid opening the chamber until the model is completely tested. Provision is also made to maintain constant density so as to take care of temperature variations.

At the door end of the cylinder is the intake of the tunnel, with a honeycomb structure for straightening out the air as it enters the tunnel. At the other is a suction fan which draws the air through the tunnel at a speed of 90 m. p. h. past the model suspended at a proper point between the two.

At the rear of the fan is a partition

The N. A. C. A. Compressed Air Wind Tunnel

so designed as to divide and divert the air into a return stream between the walls of the wind tunnel and those of the tank, back to the intake end of the tunnel again.

The speed of the air can be varied to known speeds through altering the r. p. m. of the fan, which is shaft driven through stuffing boxes from the outside of the tank.

Models of a span of 2 feet may be tested, but the results are expected to be strictly comparable to similar data for a full-sized airplane spanning 30 feet in free flight at 100 m. p. h.

The utility of the old type of wind tunnel is limited by the fact that owing to a "scale effect" the results of tests on small models, usually about 1/20th scale, are not immediately applicable to the full-sized machine. Obviously, it is desirable to obtain results strictly proportional to those obtained in free flight. This condition may be realized by the use of a wind tunnel in which the air is compressed to about 20 atmospheres, or more, in order to compensate for the difference in the "scale" or Reynolds number for the model and for the full-sized airplane.

Will Captive Helicopters Replace the Observation Balloon?

Flight of 1 hour with Kármán-Zurovec Machine—Many Advantages Claimed in Artillery Adjustment—A Flying Machine That is Tied Down for Flight.

"WELL, here it is—what good is it," said an aeronautical engineer as he watched the successful flight of the Berliner helicopter this last summer.

"What good is a new born babe," was the retort of an army officer not unfavorably known for his advanced and broad ideas and unquenchable initiative. "It's got to grow and make a place for itself."

The helicopter idea is most as old as the airplane. Some had the idea it could be put to practical use, not only in war but in peace.

What might not be possible in war, say, with a little frame, an armored box for the observer, electric motor and screws, driven up to any desired height through electric current from a portable power plant, and held captive. Might it replace the bulky and comparatively unwieldy kite balloon.

For the helicopter is claimed low perceptibility, smallness of target, non-inflammability, possibility of armament against enemy aircraft, especially good field of fire overhead, especial adaptability to shipboard use, rapid movement of position, a use as masts for radio, for the conduct, unmanned of meteor-logical observations, and as protection of open cities and coasts.

It is claimed by its proponents that it can replace the balloon and effect a saving in personnel. A comparison is made between the personnel for a German balloon company with 1 balloon and that for the helicopter:

Balloon Company
1 auto winch car
2 gas cars
3 auto trucks
6 officers
137 men

Helicopter Unit
1 auto and three trailers
1 auto truck
6 officers
20 men

Getting Clear

Speculation as to the achievement of actual sustentation is of the past. The Berliner machine actually flies free, successfully. The Kármán-Zurovec machine actually flies captive, successfully.

The Petróczy - Kármán - Zurovec Captive Helicopter

The present renewed interest in the direct-lift machine warrants the recollection of hitherto unpublished information on the machine of Dr. Kármán, which made so many successful flights in 1918, before the conclusion of the war, under official auspices.

The Petróczy-Kármán-Zurovec captive helicopter, which apparently has proved the most successful of all foreign experiments of this character, is the work of Theodor v. Kármán, retired professor of a technical high school at Aachen.

In 1916 Lt.-Col. Stefan von Petróczy, in command of an Austrian instruction balloon company, proposed to the Austrian war ministry the idea of a captive helicopter. Funds were subsequently obtained and experiments started, with the assistance of an engineer, W. Zurovec.

After tests with slow speed propellers, with rubber driven models, and a compressed air engine, two full sized systems were commenced: one with electric power and the other with rotary gasoline engines.

On account of difficulties with the electric motor, this line of work was discontinued, though the machine climbed to a moderate altitude with three persons.

Description of Second Machine

The second project resulted in flights up to 60 minutes. This machine consisted of two co-axial propellers turning in opposite directions, both of 6 m. diameter, operated by 3 captured rotary Gnomes, later replaced by 120 h. p. Rhone engines turning at 1250-1300 r. p. m., driving through a common bevel gear the two shafts, one within the other, which drive the two screws in opposite directions. Gear ratio 1:2.25, so that at full speed the screws turned about 560 r.p.m. The entire power plant and the screws were mounted in a triangular frame of tubing, welded. The three arms were fastened to the central case by bolts for quick disassembly. The three arms carried the fuel tanks which acted as the outer supports of the engines.

In the Air

The whole structure rested on a 1 m. diameter buffer and each of the three arms had a smaller air buffer, with pressure relief valves. It is reported that by this central arrangement and the common gear there is a constant equality in the revolutions of the two screws, so that torque moments about the vertical axis and about the horizontal axis are avoided.

The observers' car of veneer was placed above the screws, the car measuring 1.5 m. high by 1.3 m. in diameter, rigidly fastened through the hollow inner shaft to the stationary gearbox. On the edge of the car was a machine gun mount, and inside was the parachute.

The propellers were of wood and had a diameter of 6 m., and a changeable, especially calculated pitch, taking into account the fact that the lower one works in the slipstream of the upper. The ratio, lifting capacity, efficiency in h. p., depends, for the screw, on the "unit load", or the load of the unit of the area circumscribed by the screw tips. With a small unit load a better lifting capacity results, while with a greater unit load a smaller lifting capacity for each h. p. is obtained.

Lift Obtained

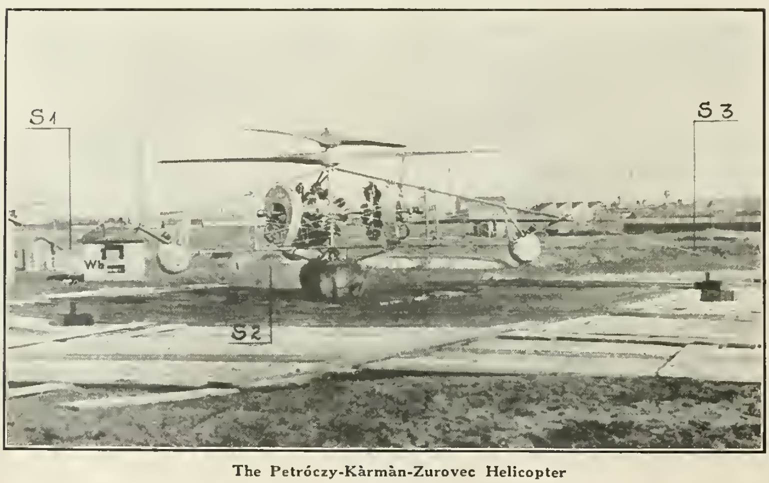
For 560 r. p. m. a lift of 5.5 kg. per h. p. was obtained. When the two screws are arranged one above the other, the unit load naturally is increased and the value 5.5 kg. h. p. must be reduced. The constructors found for the finished machine a lifting capacity of 4.5 kg. per h. p., which "value can be increased by increasing the diameter."

The four buffers were filled with compressed air, the central one taking the main weight and the three smaller ones for absorbing side shocks in alighting with one side low. All buffers had pressure relief valves and a verticle drop of 7-8 meters a second could be taken care of without injury to the engines and gear. Ordinary landings were very gentle. A falling speed of 8 m. a second would be reached only in the event of two of the engines being out of commission.

In the observation car a parachute of 250 sq. m. surface was provided, opened mechanically, and it was expected that such a 'chute might be expected to carry the whole machine, including observer, in event of complete failure of power plants. But, it is claimed that two engines alone will let the apparatus down sufficiently gentle, and that even two engines may be out of commission and the buffers will absorb the shock.

Anchorage

Three cables, leading from the 3 arms of the machine, ran over as many pulleys on the ground to 3 winches on one shaft, 70 m. from the machine, the 3 pulleys being at the



The Petróczy-Kàrmàn-Zurovec Helicopter

points of an equilateral triangle, varying in dimensions according to the altitude to be flown. From trials it was found a baseline of 200 m. was required for an altitude of 1000 m. though the trials were all made at the relatively low altitude of 20 m. One of the 3 winch drums was keyed to the shaft, while the two others ran lose and had separate power, so that each cable could be shortened or lengthened independent of the two others. These drums measured 0.5 m. diameter and were operated by a 20 h. p. electric motor. A manometer measured the total tension of the 3 cables. By means of the cable arrangement the helicopter could be controlled and steered from below, within limits.

Operation

In starting the ascensions, conducted near Budapest, the engines were cranked the starting of one forcing the others to function. The operator has control of the engines at his seat in the car and the operation of the winches was at his order. In the trials, the machine rose with a velocity of 1.2 m. per sec. The helicopter was drawn down by reversing the winches, while the engines ran at full speed, no experiments having been made with throttling.

Weights

The total weight of the machine, inclusive of power plant and fuel (140 kg.) for one hour without observers, amounted to about 1250-1300 kg. (2750 lbs.). Approximate measurements at 1350 r. p. m. and an estimated efficiency of 390 h. p. gave a lift of 1755 kg., or 4.5 kg. per h. p. It is seen that in flight the helicopter is pulling at all times against the cables.

Flights

Trial flights were made on a number of occasions in the Summer of 1918, the longest lasting 60 minutes. The machine was found to remain stable with wind velocities of 8 m. per sec. The anchorage system was proven satisfactory, for the machine could be controlled and steered in any direction, the principal condition being a sufficient surplus of lift which stresses the cables accordingly.

The excess of lift, measured just above the ground, ran from 150 to 200 kg., according to weather conditions. At an altitude of 40-50 m. the excess lift decreased to 40 to 60 kg. and it often happened that, owing to unequal running of the engines, there was no excess lift. However, when the excess was sufficient to keep all 3 cables taut the machine remained perfectly motionless; on the contrary, if it hovered a few seconds without an excess of lift, the machine commenced to gradually oscillate. These oscillations could be stopped by hauling in on the lines, when the tautened ropes would quiet the machine within 15 or 20 seconds.

In all, more than 30 successful ascents were made, from 1 to 50 m. altitude, hovering sometimes nearly a half hour quite motionless at 50 m., and, by guiding it at the winch, its position horizontally could be shifted in any direction.

McCook Field To Move

THE Government is to accept 5000 acres east of Dayton, including the field where Wilbur and Orville Wright conducted their first flights in the presence of witnesses in 1904, 1905 and subsequently.

Negotiations are being concluded with the Government by the Dayton Air Service Incorporated Committee, a corporation, which had charge of the campaign in which more than $400,000 was raised for the acquirement of the property. After paying for the land it is expected there will remain about $100,000 as a nucleus for a fund for a monument to the Wrights.

The land is 1½ miles east of the city limits, extending from the village of Riverside to and including Wilbur Wright Field, comprising about 4325 acres. The tract is the gift of the city of Dayton under the condition that it revert to the city in the future event that it is abandoned as a flying field site.

Dayton publicity announces that the Air Service plans an expenditure of $10,000,000 in buildings and equipment.

The site of the present experimental station of the Army Air Service engineering division belongs to the General Motors Co. and it is impossible to obtain a sufficiently long lease to warrant further tenantcy, the new site being selected from among numerous offers from other cities.

McCook Field now has the second largest payroll in Dayton, which means an annual payment of $2,000,000 to $5,000,000. Dayton also receives continuous worldwide publicity, from the Government aircraft experiments, employment is given from 3000 to 5000 skilled men, building of new homes is aided, the populations increased as well as that of the retail merchants, and it is expected that aircraft manufacturers and visitors will be drawn to Dayton through the permanent location of this station.

New Orleans—Pilot Town Air Mail

THE following data has been received from the New Orleans Association of Commerce with regard to the proposed Air Mail Service between New Orleans and Pilot Town.

The Service was proposed by the New Orleans Postmaster with the enthusiastic support of the Postal Facilities Committee of the Traffic and Transportation Bureau of the New Orleans Association of Commerce.

New Orleans has an airplane landing field located at the old city park race track now owned and controlled by the city of New Orleans. There are no hangars on it. Its location is slightly north-west of the foot of Canal Street, about four or five miles from the point where mail is to be taken on for Pilot Town. There is another field in the upper section of the city, commonly known as the Peters Avenue Airplane Landing Field, which was used during the American Legion Convention by sixteen airplanes. There are no hangars on it, and the owner is unwilling to give a long lease.

In the opinion of the New Orleans Association of Commerce, land planes are useless for the proposed service to Pilot Town, the reason being that the fields in New Orleans are too far distant from the mail terminal and that at Pilot Town no land facilities exist, the town itself being built on stilts driven into marshy soil.

Hydro-airplanes are absolutely necessary. In New Orleans hydro-airplanes can make a landing conveniently in the river, both at the foot of Canal Street where the river is ¾ miles wide, and at Pilot Town, where the river is 1¼ mile wide.

The airplane operator taking the Air Mail contract would not also be obligated for the transportation of the mail from the New Orleans Post Office to the air terminal, this being a separate contract under the local Postmaster.

It is regarded by the New Orleans Association of Commerce as necessary for the operator to have a motor boat at Pilot Town, in which to handle the mail to the steamers from the plane. It is possible that a satisfactory arrangement could be made with the Pilots' Association, whereby mail would be transferred in the same motor boat used by the pilots in transferring from incoming and outgoing ships to the wharf at Pilot Town.

There are 91 steamship lines entering the port of New Orleans, which the Association of Commerce believes would give the airplane operator an average of at least 300 lbs. of first class mail each trip.

© Official U. S. Navy.
This flock of Navy carrier pigeons, circling about the "wireless" mast at the Naval Air Station Anacostia, Washington, are all trained messengers, some of them have won world's records. The revival of the breeding of such birds in America is directly due to the demands of aviation.

Aviation Pays Its Way

By Conway W. Cooke

National Aeronautic Association of U. S. A.

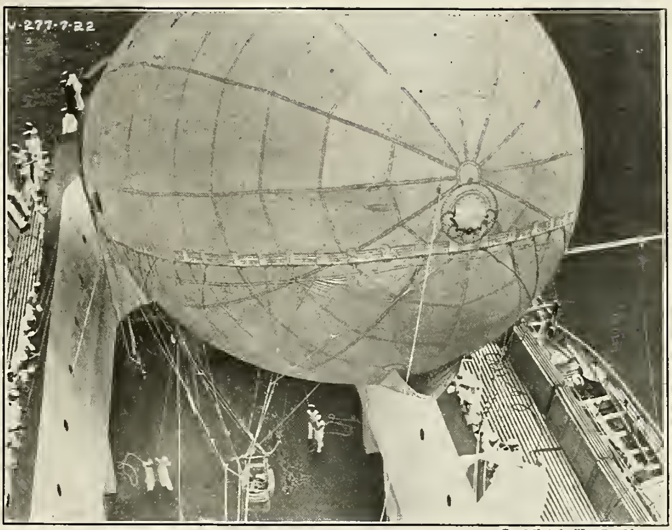
NOTHING wears out its welcome so quickly as an institution which "feeds" from the public treasury without showing tangible and immediate returns. It is the misfortune of certain governmental bureaus to be forever engaged in experimentation and research—thus always in need of money, and fated to have their work buried under official blankets; while those bureaus whose activities are rated as "confidential" and "secret", much of their efforts never uncovered to public view, are "anathema" and thornlike to Congress. This last is the case of military and naval aviation—Congress doesn't like them; probably never will.

Yet those two air services, notwithstanding their problems of extensive investigation, and the fact that a considerable portion of their appropriations are spent on problems involving the greatest secrecy, this secrecy for obvious military reasons—really repay the nation many fold for every penny used. Those very research experiments which seem so wasteful to the uninitiated are the things that pay the most. For nothing is lost; the mysteries of chemistry, of metallurgy, the queer behavior of metals under heat, the mechanical processes of the laboratory, and the salvage of seemingly unimportant by-products resulting from the solving of definite problems placed before our aeronautical engineers, are turned over to our industries for the benefit of the nation at large.

Duralumin, an aluminum alloy with the weight of aluminum and the strength of tensile steel, one of the most important metals in industry, has just been put on the industrial market as a result of the Navy's efforts to build airships of the rigid type and equip itself with all-metal airplanes. Four years ago duralumin had never been produced in this country. It was a product of German ingenuity, and its development in that country made possible the building of the huge Zeppelins which proved to be such a pest to England and the British fleet. If we were to have all-metal planes and rigid airships, we must needs produce duralumin. The German secrets were too well guarded to become our property. Analyses gave us the composition of the alloy, but the heat treatment process we could not fathom.

However, the Navy placed contracts for duralumin with private concerns, awarding them on specifications which were deemed to be the basis of success. At the same time the Navy undertook experiments of its own, and the combined effort brought forth a type of duralumin of greater tensile strength than the German product. With this metal the Navy is now building the rigid airship ZR-1, under construction and assembly at the Naval Aircraft Factory at Philadelphia and the Naval Air Station at Lakehurst, New Jersey. In addition, both the Army and Navy are contracting for American-built all-metal planes of duralumin; while the aeronautical industry of the country is revelling in all-metal planes of American duralumin. What this new metal means to the manufacturing fraternity throughout the Nation cannot be estimated in dollars and cents. Here is one governmental problem, the solving of which has paid for many expensive experiments.

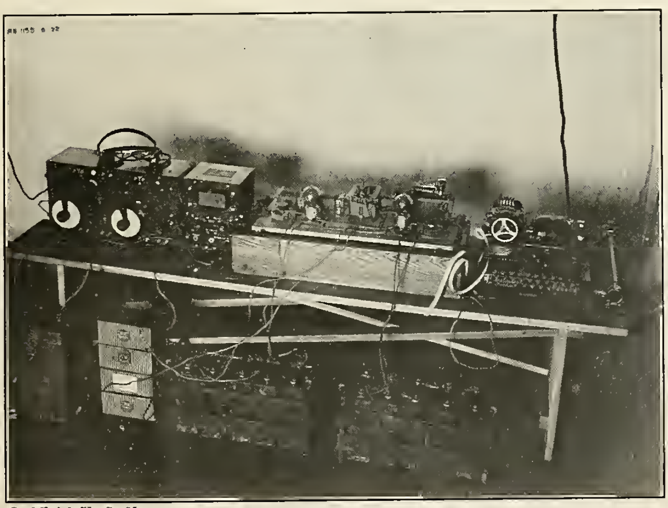
In their efforts to improve the motive power of aircraft, the aeronautical engineers of the Army and Navy have benefited the whole internal combustion engine industry, together with the fuel and lubricating industries so closely allied therewith. Aircraft engines are high-speed power plants; they are called upon for extreme speed under adverse conditions, yet they are the lightest in weight for actual horse power produced of any type of engine in practical use. Strength of materials, heat resisting alloys, lubricants of unusual viscosity, fuels of the most efficient character—all to be used in combination to give a power plant of the utmost flexibility and performance, came into the problem of aircraft design and experimentation.



© Official U. S. Navy
The perfection of balloon fabrics have had a direct influence on the price and quality of your own raincoat. A Navy kite balloon is here shown being housed in the balloon hold of the aviation mothership Wright.

How well the engineers succeeded in their chase for the ultimate may be gathered from the fact that our Army Air Service holds the world's records for endurance, altitude, speed, and long-distance non-stop flight. Seven miles above the ground; a day and a half in the air without stopping; a speed of four miles a minute; and 2060 miles without a stop are the records. They would be impossible without the most efficient engines ever built.

What has all this got to do with the nation at large? Much. Aside from placing the United States in the position of world leadership in the aeronautical field, the improvements in aviation power plants have been incorporated into the automobile industry, resulting in motors of greater flexibility in operation, with longer life, less affected by heat, more readily overhauled and, better yet, less expensive to build and maintain. In fact, all types of internal combustion engines have followed along with the developments in aviation engines; this means the saving of millions to the public at large, and the reduction of appropriations for the upkeep of governmental equipment depending on such engines for motive power or stationary use. Whatever the Army and Navy has spent for the development of aircraft engines can be no more than a pittance in comparison to the economic returns.



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This is the "Teletype" receiving apparatus which types the message from a seaplane as fast as the sender can operate his equipment. This is only one of many developments of tremendous value to the radio communication service which is directly due to the solving of a problem in air navigation.

In the development of flying boats and other naval aircraft, many products have been newly invented, while others have been so improved that their use has been multiplied many times over. This is true of marine glues and varnishes, for not only have these products been made impervious to water, but heat and friction resisting to an astounding degree. These improvements are already reacting on the refinement of motor boats and yachts, automobiles, railway coaches, and outdoor furniture. Even the search for high-grade balloon cloth and the manufacture of aviators' clothing has influenced the production of waterproof clothing and fabrics impregnated with rubber for a thousand uses. Thus, aviation has brought about economic changes in the rubber-cloth industry, in the cotton duck industry, and in the silk industry. Because of aviation's necessity, your raincoat is a better garment and costs you less than the unimproved type of a few years ago.

In the rush of aircraft building by the wholesale, many furniture-making establishments and piano factories were taken over *en toto,* by contract, by the Aircraft Procurement Board. These manufacturies naturally continued their old processes in veneering, dowelling, turning, and laminating. It soon developed, however, that the extreme speed of airplanes and seaplanes, together with the continued exposure to damp air and seawater, demanded something more rigid and substantial than the accustomed methods of these manufacturies could produce. In the end, new methods of wood curing, new types of turning machinery permitting the mechanical shaping of struts, propellers, and wing braces; improved laminating processes; and more scientific selection of veneer woods, succeeded the older practices. These improvements have been retained by the industry and are incorporated into the manufacture of articles wholly or partly made of wood. While the woodworking industry has not been revolutionized by the influence of aviation, it has been materially affected, and for the better.

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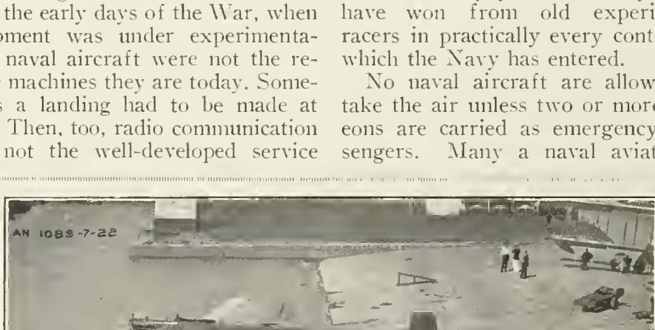
Women have taken their place in the aeronautical industry. These women are working on the fabrication of balloon cloth at the Naval Aircraft Factory at Philadelphia.

Perhaps one of the queerest developments of aviation having an effect on the sports, rather than the industries, is that of the Pigeon Service connected with the naval air force. Homing carrier pigeons have been bred and used for thousands of years; in this country they have been bred and raced by fanciers since early days. It remained for the Navy to rejuvenate this "sport" and make the breeding of "racers" a very profitable undertaking.

In the early days of the War, when equipment was under experimentation, naval aircraft were not the reliable machines they are today. Sometimes a landing had to be made at sea. Then, too, radio communication was not the well-developed service we know today; hence, some means of communicating with shore stations or ships from stranded or drifting planes other than electrical or visual had to be provided. The answer was: carrier pigeons. The problem was solved by enrolling, as Chief Pigeon Officer, Lieutenant James J. McAtee, a breeder of homing carrier pigeons at Pittsburgh and the foremost authority on pigeons in America. By securing the best strains of domestic birds and crossing them with the best from foreign sources, Lieutenant McAtee has produced the most wonderful racers in the world. Even the very youngest Navy birds have won from old experienced racers in practically every contest in which the Navy has entered.

No naval aircraft are allowed to take the air unless two or more pigeons are carried as emergency passengers. Many a naval aviator is alive today because of these little birds, and thousands of dollars worth of equipment now in use would have been utterly destroyed and sunk had the carrier pigeons been wanting. "Down at sea" with radio out of commission, especially in a storm or in a tideway at night, is a very serious affair. Then, a seaplane's crew have no other means of giving their whereabouts except by winged messenger; to the Navy, such birds are worth a king's ransom; due to the Navy, their breeding has been re-established as a paying industry.



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All-metal torpedo plane designed for the Navy by Mr. A. H. G. Fokker the celebrated aeronautical engineer who produced the Fokker planes so much used by Germany during the War. In order to provide metal for such planes as this, duralumin was added to the useful metals in our industry.

One of the most important phases of aeronautical development which has had an immense effect on the electrical industry is the constant effort to improve radio communication while flying. Money appropriated for military and naval research and experimentation along these lines is like the proverbial "bread cast upon the waters"; the returns are incalculable—the whole world benefits by the results obtained.

It is not difficult for the novice to understand the absolute necessity for a rapid and reliable means of communication between planes in the air and their ships and stations, or that planes must talk to each other *by* some means. Only by such communication can aircraft be tactically used in warfare. We must know what the pilot and observer see; we must tell them what we want done next; they must be controlled like any other element of our command. In the Navy, aircraft are the eyes, ears, and tentacles of the fleet—they must be connected to the fleet at all times by a "nerve"—in this day and age, the

(Concluded on page 23)

Maintenance and Operating Equipment of Airplane and Seaplane Stations

Types of Equipment for the General Maintenance of Stations, for their Operation and for the Servicing of Aircraft, with some Approximate Costs.

By Archibald Black

Consulting Engineer, Garden City, N. Y.

General Classes of Equipment

The equipment required at airplane landing fields and seaplane stations will vary greatly according to the use of these. Military and Naval stations present special needs which are not in any way comparable with those of civil stations. Such equipment must do more than provide for immediate needs, it must be sufficient to permit very rapid expansion in event of outbreak of hostilities. As a consequence, the average Army field or Naval air station is very completely equipped while most civil stations are limited to the barest necessities. The greatest potential development being along civil rather than along military lines, this dicussion is confined largely to the equipment of civil stations. No matter whether these stations are municipally or privately operated, the equipment will be substantially the same. Leaving aside the questions of buildings and of repair equipment, as outside the scope of this article, the equipment may be divided into the three general classes:

1. Maintenance and general.
2. Servicing.
3. Operating.

A detailed list of the equipment falling within each of these classes is given in Tables 1, 2 and 3. These tables are very complete and include probably every item excepting the small tools required. Indeed, the complete lists contain many items which may not be found at some very completely equipped stations. The tables are not intended as lists of the equipment necessary at *every* station; items would necessarily be selected in accordance with the special needs of the one being considered. No attempt has been made to arrange the lists with items in any order of their importance as this varies so greatly with each case. However, those arranging the purchase of equipment should have little difficulty in using the tables as guides to compile a list of equipment suited to their particular needs and to the funds available. While the costs given in the tables are, necessarily, approximate, they are sufficiently close for use in balancing need against price and in compiling preliminary estimates.

Most Stations Under-equipped

It has been quite customary to operate stations with very little equipment in most cases to date, the lack of funds making initial investment of more importance than operating efficiency. As the use of these stations grows, the poor efficiency, due to this lack of equipment, may be expected to become more felt. At the same time, the increasing use of the stations which causes this will also tend to make additional funds available for purchase of necessary items. We may therefore expect to see the market for air station equipment develop gradually in the near future in about the same manner as the market for garage equipment developed in the past decade. Few civil stations and only a limited number of those operated by the Army and Navy can boast of lists of equipment comparable with those given in the tables. Nevertheless each item is more or less necessary according to the extent to which the station is used. Insufficient funds is generally the chief reason for meagre equipment.

General Station Equipment

The list of station maintenance and general equipment contains no specially designed items. In each case apparatus already on the market is available which is suited to the purpose. A complete equipment of hand fire extinguishers should always be furnished and, where the development justifies, fire engines should also be provided. In purchasing fire equipment particular care should be used to select that suitable for the purpose. Most extinguishers on the market are almost useless for extinguishing gasoline and oil fires, a hazard always present at all air stations, while each type of fire apparatus is particularly suited to certain purposes. The fire alarm need not be an expensive automatic system as any conveniently available, manually operated, gong or bell is sufficient to call all hands together in case of an outbreak. The electric power and light unit will not be required in any case where the electric power can be obtained from outside sources. Where not available, any reliable farm lighting set can be used, the capacity being governed by the area of the buildings to be lighted, etc. The tractor, grass cutter, road drag, and other field and road maintenance equipment included in the list are not often found at stations. Their purchase is however, very desirable as the surface of the field, roadways, runways, etc., can be maintained by the station laborers at very little cost if such equipment is on hand. A very small amount of rebuilding or new construction work is sufficient to cover their cost and, once purchased, there is less danger of the roads and runways being neglected. The light truck included in this list is intended to be used not only for transportation of materials but also for carrying the staff to and from the station as well as for emergency work.

Gasoline, Oil and Water Equipment

Gasoline and oil storage and water supply constitute the first essentials at any station. The safest, most economical and most generally satisfactory method of storing gasoline and oil is in underground tanks which are furnished with measuring pumps. In most cases available funds will not permit the installation of such tanks for both and, in some cases will not permit it for either. Where the under ground tanks are used, any of the approved makes of tanks and pumps now on the market may be used. The tanks should not be located under any of the buildings, roads, runways, etc., and the filler pipe and vent should be located some distance (say, 50 to 100 feet) away from buildings. The pump should be provided with means for locking it to prevent pilfering and it should be of the measuring type. Where gasoline is stored in underground tanks and oil in the original barrels, a satisfactory method is to locate the oil barrels and the gasoline pump in a small outhouse. Where the underground tanks are to be installed it is not advisable to provide tanks of less than 550 gallons capacity as the saving by using smaller tanks is barely

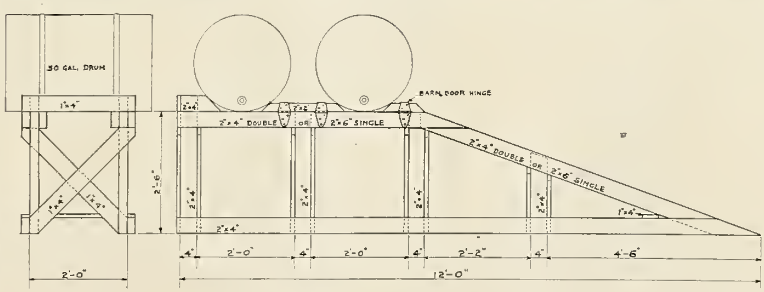

Fig. 1—Oil and gasoline barrel rack.

worth while. The complete installation of gasoline storage systems of this capacity, including tank, filler, a high grade measuring pump, strainer, pipes, etc., can be made for around $310.00, while the system of half this capacity would only cost about $50.00 less. A cheaper type of pump, with some of the improvements and accessories eliminated, but with the same capacity of tank (550 gallons) can be installed complete for about $200.00 to $225.00. Underground storage systems of one tank car capacity (10,500 gallons) including tank, measuring pump, etc., can be installed complete for about $900.00.

If either the oil or gasoline and oil are to be kept in their original barrels, a rack should be constructed for them to facilitate emptying. Such racks may be constructed of any lumber conveniently available at the station and should provide for one full and one partly empty barrel of each liquid. Unless a track for chain tackle is to be installed over the rack, skids or inclined ways should be provided to facilitate the work of placing barrels on the rack. Figure 1 shows a very simple and suitable rack of this type which is provided with inclined ways up which the barrels may be rolled manually. All oil or gasoline used inside of the hangar or shop buildings should be kept in either portable safety cans or portable tanks of an approved type. Figure 2 shows a suitable type of small safety gasoline can which is available on the market. In arranging provision for the storage of gasoline and oil it is advisable to provide for about 12 to 14 times as much gasoline (by volume) as oil. While this is approximately the

Fig. 2—5-gallon safety gasoline or oil can. (McNutt)

relative consumption, the storage capacities will also be affected by other considerations such as those of purchasing.

As to the matter of water supply, where some outside source happens to be available this becomes simply a matter of extending the pipes into the station buildings. In many cases, however, such sources will not be available and it will be necessary to either drive wells where underground water exists or to truck it where not. In either of these latter cases a water storage tank should be provided and protected against freezing.

Oil and Water Heaters

Oil and water heaters are very necessary items of equipment at all stations in northern localities where flying is to be continued through the winter. Not only is difficulty to be experienced in starting airplane engines with cold water and oil in cold weather, but there is also a danger of the water freezing in the engine before it can be started. In cases where very little flying is to be done in cold weather, it will be found sufficient to arrange a heating system by using a small water-back kitchen range, or small water boiler, with the connections coupled to circulate the water through an open top barrel. The water can be drawn from this barrel through a faucet at the bottom while the oil can be heated by placing a 5-gallon can of it inside of the barrel, care being taken to keep the top of the oil can above the water level. A system of this kind can be installed complete, including all material and labor, for $40.00 to $70.00 depending upon how much of the material happens to be already on hand. This outfit is not convenient to use and it is much more satisfactory to install a properly designed heating system where possible. Such complete systems can be arranged quite economically, by using a small water boiler and two cisterns of the type ordinarily used in connection with the hot water systems in small buildings, as shown in Figure 3. An installation of this type will cost about $200.00 to $225.00 to install complete. As any water and oil heating system can be counted upon to heat a small room in which located, it will often be possible to make this the only heating system at the station.

Wheel Chocks and Handling Dolly

In regard to equipment for handling airplanes on the field, wheel chocks and a small truck or "dolly" for carrying the tail skid are very necessary. The chocks are used under the airplane wheels to prevent it from moving while the engine is being warmed up, while the "dolly" is

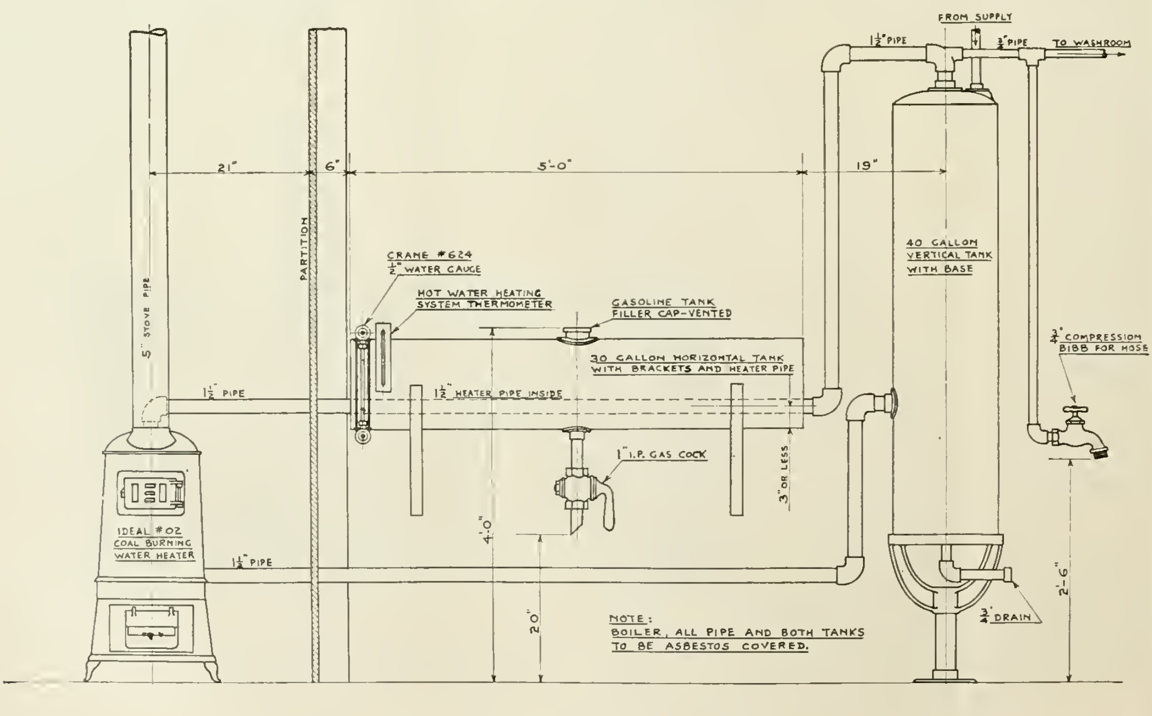

Fig. 3—Oil and water heating system.

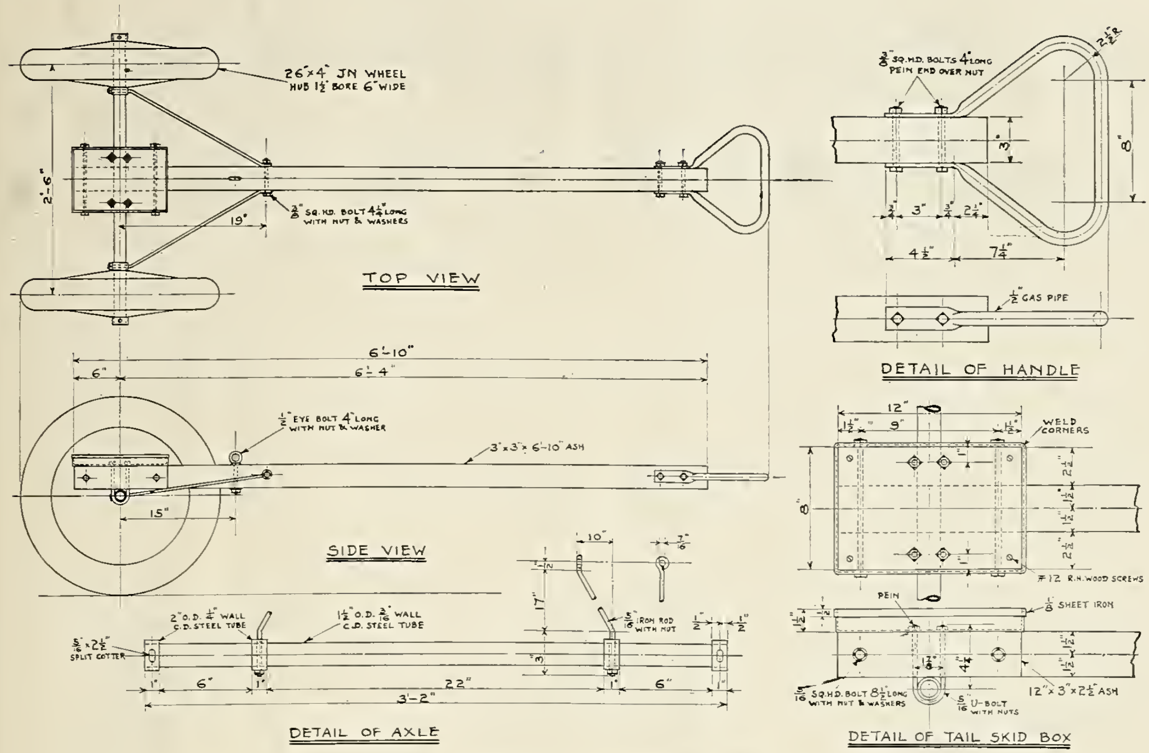

Fig. 4—Tail skid towing and handling dolly

used to carry the tail skid of the machine while it is being moved manually on the field or into and out of the hangar. The wheel chocks can easily be made by the station mechanics from any lumber which may be handy, while the "dolly" can often be also improvised from any old wheels, axle and lumber which may be available. Figure 4 shows a type of "dolly" which can be used for practically any land airplane and which is built of parts usually available at stations. Figure 5 shows a type of wheel chock which can be similarly constructed and is suitable for use with any size of wheel excepting, possibly, the very large bombing airplane ones.

Beaching Runway and Boat Trucks

If only equipment for water types of machines is being considered the wheel chocks and "dolly" will not be required. Instead, a beaching runway or track will be necessary and also one specially designed handling truck for each flying boat or seaplane. The runway or tracks should extend from the hangar entrance, down the beach, to below low water level so that machines may be launched or taken out of the water without regard to the position of the tide. Runways may be constructed by driving piles into the sand, laying over these beams on edge and planking the beams with two layers of stout rough lumber at an angle to each other. Both thicknesses may be laid on the bias, in opposite directions, or either may be laid on the bias and the other across the runway. The planking should never be run *parallel* to the runway. If a track is to be used instead of the runway, it may be constructed like the ordinary marine railway. The width of the runways will depend largely upon local considerations. If on a level with the beach for their entire length, they may be made only a few feet wider than the tread of the truck wheels or, say, 6 to 10 feet, depending upon the size of the boats. In cases where the runway is appreciably above the level of the beach it is advisable to widen it sufficiently to enable the men guiding the wings of the machine to walk on it. As regards the width of tracks for railways, there is no particular reason for departing from the standard railway gauge of 4'-8½" (measured *between* the heads of the rails, not from center to center).

The handling trucks are, of course, provided with flat or flanged wheels according to whether a runway or track is used. In some cases, the handling truck is formed like a cradle to fit the hull while, in other cases, a separate cradle is used and is carried on the truck. Figure 6 shows a typical handling truck for flying boats, in which the cradle is built integral with it. This is generally the most convenient type to use.

Mooring and Hauling Equipment

No special comment regarding the mooring buoys appears necessary as the aver-

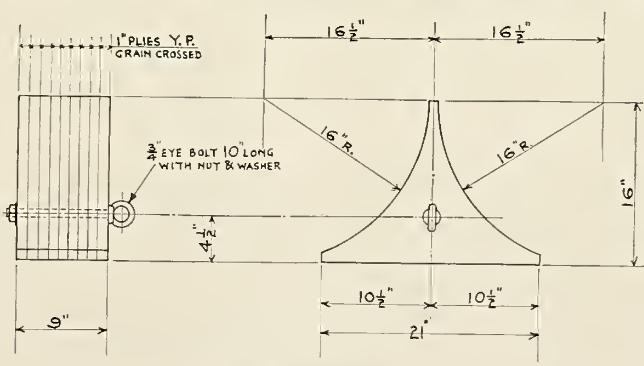

Fig. 5. Wheel chock.

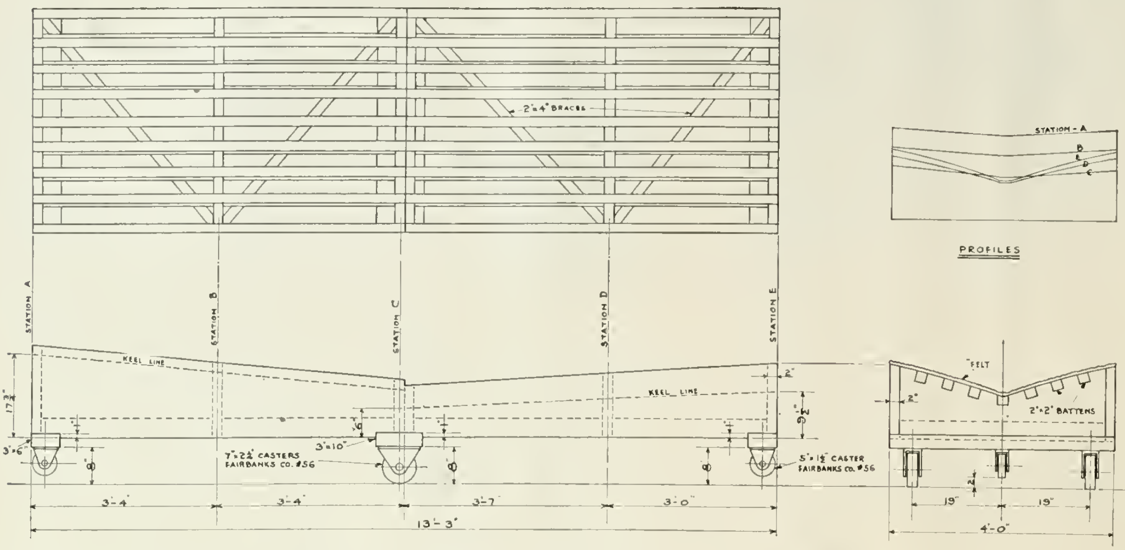

Fig. 6—Flying Boat (HS-2-L) handling truck for hard surfaced runways.

age buoy which is used for power boat mooring is equally suitable for flying boat or seaplane use. Some provision, such as a crab, capstain, crawler tractor, etc., for facilitating the work of hauling out, should be provided unless the beach is quite flat and the boats are small. The crab or capstain represent the lowest initial cost but requires more labor in service than does the tractor. Consequently, tractors should be provided in cases where considerable hauling is to be done. In other cases a crab is probably the most satisfactory. Crabs suitable for this work can be purchased locally or from some firm such as the Sasgen Derrick Company of Chicago, for $68.00 to $128.00 according to their capacity. Small winches, suitable for hauling out the smaller sizes of boats, can be purchased for $20.00 to $25.00. These figures do not include the cost of installation which could, however, be included in the runway or track construction cost without affecting it. Runway and track costs will vary so greatly that there appears to be no way of giving any general cost estimate.

Engine Starters

The portable engine starter is an item which can be omitted until these are further developed and funds for their purchase plentiful. Numerous devices have been used up to date, more in Europe than in this country, but the most of these were built experimentally and not marketed. One simple device which is on the market in Europe, the Odier starter, appears to perform well, although it has the disadvantage of placing the operator in a position where he would be liable to serious injury in event of the wheel chocks slipping. This starter, illustrated in Figure 7, uses compressed air, can be arranged to fit any propeller hub, and is convenient to move around. Many of the other starters built consisted of motor trucks carrying a shaft, driven by the engine, which could be connected to the airplane propeller hub. The English Airco motor power starter is of this type.

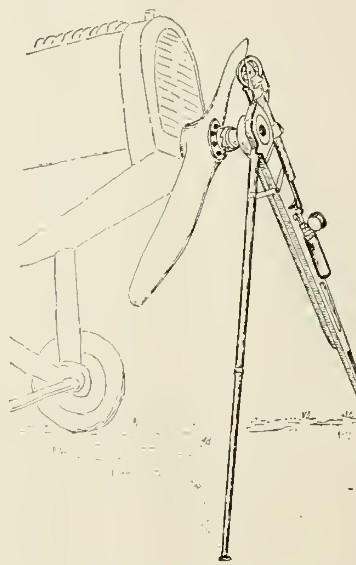

Fig. 7—Odier Portable Engine Starter

Meteorological Apparatus

The wind direction indicator is an absolutely essential item of equipment. Originally a pennant was used for this purpose but it has since been displaced by the wind cone, better known in station parlance as the "sock". In some parts of Europe automatic wind Tees have been developed and are in everyday use but only a few experimental Tees of this type have been built here. For a time, the practice was tried at many fields of laying out a white cloth Tee on the surface of the field. This Tee was moved by the station force as the wind changed. The method proved to be somewhat of an abortion and its use has been generally discontinued on account of its obvious disadvantages. The wind cone may be regarded as a very satisfactory device as it is

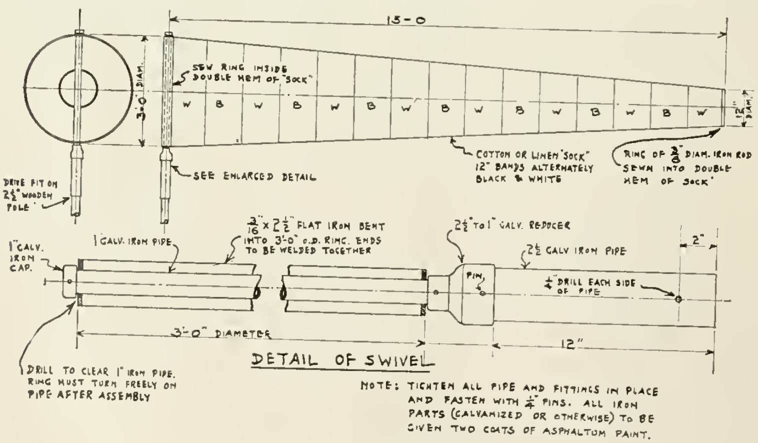

Fig. 8—Wind cone.

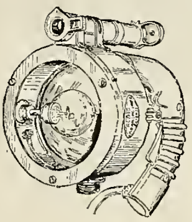

FIG. 9—Aldis Landing Signalling Lamp

economical, automatic, practically infallible, shows every little variation of wind direction and gives the pilot some indication of wind velocity by the angle at which it floats from the mast. A wind cone which can easily be constructed by either the station force or some local shop, is shown in Figure 8. This cone was designed by A. & D. R. Black, based upon an Air Service standard, rearranged to permit the use of ordinary gas pipe and fittings, instead of special parts, in its construction. The "sock" was also changed from plain white or red to alternate bands of black and white to increase its visibility. While shown 15 feet long, the same length as the original Air Service cone, the writer is inclined to regard this as rather long and considers 10 to 12 feet as sufficient. This type of wind cone, as will be noted, is so designed that it cannot wrap itself around the mast and remain in that position for more than a moment, if at all.

Traffic Control Equipment

In cases of stations which are expected to become the scene of great activity, it is advisable to furnish some type of tower or covered platform for the traffic controller to direct the taking off and landing from. This practice has been found necessary at some of the very busy European fields and may be expected to become necessary at stations here in the near future. The equipment suitable for this directing is yet in the development stage, but a megaphone and signal flags may be regarded as essentials no matter what other equipment may be later developed. Experimental installations of signalling lights and radio are now being tried out at some of the European fields. The megaphone should be large and it is advisable to provide both a hand type and a very large swivel mounted one. No standards for the signal flags have yet been developed in this country. The Aldis landing signalling light, an English development, which is shown in Figure 9, is used for signalling between the ground and aircraft desiring to land. This device consists of a 100 candlepower electric bulb, inside of a projector with high power mirror, and with a sight for directing the rays. It is held in the hand and the light flashed by means of a trigger grip switch. The Aldis light is sufficiently powerful to be used for day as well as night signalling.

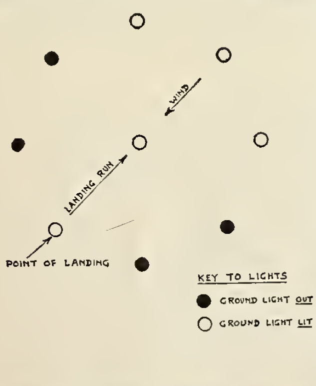

FIG. 11—Pintash Landing Ground—Light System

Night Flying Equipment

If any night flying is to be done at the station, some special equipment for this purpose will be required. A battery of powerful portable floodlights and a supply of small flares, such as those used in railroad operation, should be provided and all obstacles in or around the station should be rendered visible at night. Although not entirely satisfactory, the best method yet developed of rendering obstacles visible is that of marking their outlines with small lights. Particular care must be taken that all lights, no matter where they may be, are arranged so that they do not dazzle the pilot who makes a landing at night. The floodlights should be placed so that their beams are directed into the wind, the first of the battery lighting the exact spot where the pilot is to touch the ground, while the others illuminate the course which his machine is to take while rolling along the surface after landing. The battery should be placed with the lights close together, and to one side of the path of the airplane, in order to reduce the danger of colliding with them. Figure 10 shows a type of light suitable for this purpose and also the manner in which the battery should be arranged. At least four lights, and preferably six or more, should be provided. In arranging them it should be noted that the important points are to, first, illuminate the spot on which the pilot should set down the wheels and, second, indicate the direction in which the landing should be made. A more elaborate system than that just described is now in operation at some European fields and is understood to be working well. This method, the Pintsch system, is to install lights under heavy glass set flush with the surface of the field and arranged in plan about as shown in Figure 11. The center light is always kept burning while the system is in use and the lights around the circle are used in accordance with the direction in which the wind is blowing. The light on the side of the circle *towards* which the wind is blowing is used to indicate to the pilot where the wheels should be set down, while two or three lights on the opposite side are also lit in order to indicate the direction of the wind and, consequently, direction of landing. In the Pintsch system the lights are connected with a wind vane switch so that they automatically change with the wind.

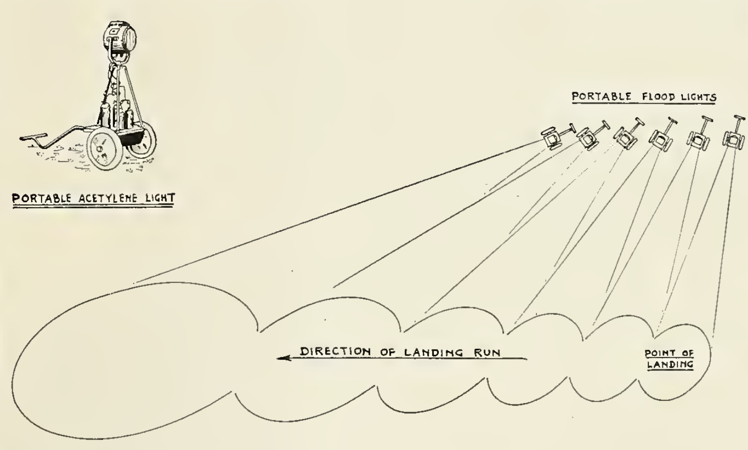

FIG. 10—Floodlight Battery for Night Landings

Beacon Lights

To facilitate finding of the field at night some type of beacon light is necessary. Very elaborate beacons have been installed and are now in experimental use in France and England. Such beacons are only necessary if night flights are to be the regular practice. For a station where only occasional night flights are to be made, and these only in suitable weather, a power-

(Continued on page 40)

The Effect of Aspect Ratio Variation Upon the Slope of the Lift Curve of an Aerofoil

A SOLUTION of the present problem, based upon the assumption of constant lift curve slope, was given by Lieut. Walter S. Diehl in N. A. C. A. Technical Note No. 79. This supplementary note is prepared for the purpose of giving a general formula which may be applied to any point on the lift curve. The formula offers the quicker method of estimating the slope when a special chart, such as that drawn up by Lieut. Diehl, is not at hand. Practical applications of the results contained herein (as well as in the note referred to above) are to be found in propeller design and in statical stability analysis.

We begin by considering Prandtl's formula for the angle of attack of an infinite wing having the same lift as a finite wing:

$$\epsilon = \alpha - 57.3\,\frac{C_L S}{\pi B^2} \qquad (1)$$

where ϵ = angle of attack, in degrees, of the infinite wing, measured from zero lift.

α = angle of attack, in degrees, of the finite wing, measured from zero lift.

C_L = absolute lift coefficient defined by

$$C_L = \frac{L}{q\,S}$$

where L is the lift, q the dynamic pressure, and S the wing area. For standard conditions $q = \frac{1}{2}\rho V^2 = .001185 V^2$, when V is in ft. per sec.

B = wing span.

We have next to consider the aspect ratio:
variation of ϵ with C_L for a given

$$\frac{d\epsilon}{dC_L} = \frac{d\alpha}{dC_L} - 57.3\,\frac{S}{\pi B^2} \qquad (2)$$

Since by definition of aspect ratio, R

$$R = \frac{B^2}{S}$$

equation (2) may be written

$$\frac{d\epsilon}{dC_L} = \frac{d\alpha}{dC_L} - \frac{57.3}{\pi R} \qquad (2a)$$

If, now, (2) is applied to two wings of different aspect ratios, at the same value of C_L, then

$$\left(\frac{d\alpha}{dC_L}\right)_1 - \frac{57.3}{\pi R_1} = \left(\frac{d\alpha}{dC_L}\right)_2 - \frac{57.3}{\pi R_2}$$

Which may be written also

$$\frac{1}{\left(\frac{dC_L}{d\alpha}\right)_1} - \frac{57.3}{\pi R_1} = \frac{1}{\left(\frac{dC_L}{d\alpha}\right)_2} - \frac{57.3}{\pi R_2}$$

It immediately follows, then, that if

$$\frac{dC_L}{d\alpha} = M$$

$$M_2 = \frac{M_1}{1 - \frac{57.3\,M_1}{\pi}\left(\frac{1}{R_1} - \frac{1}{R_2}\right)} \qquad (3)$$

If it is desired to use data with the lift given in lbs./sq. ft. at 1 m.p.h., we note that

$$\frac{dC_L}{d\alpha} = 390.6\,\frac{dK_y}{d\alpha}$$

and one can write in engineering units

$$M_2 = \frac{M_1}{1 - 7123\,M_1\left(\frac{1}{R_1} - \frac{1}{R_2}\right)} \qquad (3a)$$

The above formulas, depending essentially upon Prandtl's equation (1) are based on an elliptical lift distribution over the span of the wing. Experimental results seem to indicate that this form of assumed distribution for ordinary wings is accurate enough for practical work.

For application in propeller design, the slope of the lift curve of an infinite wing is immediately obtained by letting R_2 approach infinity in formula (3). It is to be noted that when

$$M_2 = M_1 = O$$

the maximum lift has not changed with aspect ratio: a result given by theory and found to be very approximately true in practise.

New Monoplane Control Proves Successful

IT was announced at the Aeronautical Chamber of Commerce that flying tests made recently by Grover Loening, the aeroplane constructor, had demonstrated the complete success of a new type of aeroplane control invented by him that has aroused great interest among aeroplane experts.

The tests were made from the East River off Thirty-first Street, where the Loening factory is located, and for the trials, the monoplane Air Yacht owned by Mr. Harold S. Vanderbilt was used in charge of Mr. Vanderbilt's pilot, S. W. Cogswell.

Since much of the weather during the week consisted of high Northwesterly winds blowing across the river and full of violent and disturbed wind puffs, due to passing over the city, the severest conditions were experienced during the trials.

Ordinarily, flying so near the city under these conditions, with the additional necessity of the hydro-aeroplane having to take to the air from the river sideways to the wind, would have been considered quite impractical and dangerous, but equipped with the new Loening control, the aviators found the machine so responsive in overcoming wind puffs that flying under these conditions was entirely safe.

This significant development is thought by experts to open up a wider field for the aeroplane in that it enables flying to be done under adverse conditions in the very heart of a city, where the air is ordinarily considered too "rough" for flying.

The new invention which is called a lateral "pressure equalizer" is mounted on the extreme tip of each wing and departs radically in its effect from the fundamental principles of lateral control as used in the Wright and Curtiss types of control. Previously used systems for lateral control on wings have always mounted the movable surface or "Aileron" as it is called by aviators, on the rear or trailing edge of the wing, fastened back of the rear spar of the wing. The competition in the recent air races in Detroit, however, where many monoplanes made speeds of over 190 miles an hour, even though not streamlined as well as the biplane racing machines, proved that the old type of control of the monoplanes with an aileron at the rear of the wings became increasingly ineffective with high speed. This feature was studied by many experts and it was found that the tendency of the old type of lateral control was to put twisting stresses on the wing itself which neutralized the controlling power of the ailerons in such a way as to make the machine stiff on the controls.

New Loening Control

The "pressure equalizer" invented by Mr. Loening has been found to do away with this effect because the movable surface used to obtain more lift on one side than the other, is placed entirely in front of the center of the wing, so that the effect of this increased pressure in tending to twist the wing causes the twisting stress to be completely reversed in favor of the lateral control instead of against it. The operation of the movable pressure equalizer tending to lift one side of the wing causes the angle of incidence of that side of the wing to increase, thus still further amplifying the controlling power and completely equalizing the twisting stresses induced by the old type of control.

The construction of the new device is quite simple, in that a small section of the leading edge of the wing is extended out beyond the tip to which is hinged the pressure equalizing flap, which is controlled through cables and levers by the pilot. Mr. Loening claims that the new device is so effective that the use of the trailing edge aileron now practically universal on all aeroplanes may be eliminated entirely and much more controlling power obtained with the new device with 1/4 the area of movable surface, and with a great reduction in the power that it is necessary for the pilot to apply to his control stick.

New Loening Control

The new device is said to again emphasize the qualities of the monoplane in comparison to other types of machines in that it is now possible to preserve its lightness and simplicity without any sacrifice of control whatsoever, and to obtain the best advantage the superiority in speed and climbing power which has already led to the adoption of the monoplane from a commercial standpoint by many constructors throughout the world, such as Fokker in Holland, Dr. Junkers in Germany, DeHaviland in England and the Nieuport Company in France.

The invention can be applied to biplanes and other types of machines but is most valuable for monoplanes due to the depth of chord of their wings.

The successful tests of this leading edge type of aileron to equalize the pressures necessary for lateral control, as developed by Loening, is in favorable contrast to the numerous experiments that have been conducted by constructors and by the government for years with trailing edge ailerons by increasing their size and increasing the size of the "balance" in order to achieve a better lateral control.

England Builds Giant Torpedo Plane

IN GREAT secrecy the Supermarine works is building for the Air Ministry a naval air craft of the torpedo type, with a number of interesting features, at a cost of $160,000.

The hull has been designed for actually "living afloat." The bow is carried very high and has, from ahead, the appearance of a normal motor boat, with the usual stem, sheer and a flare at the top line in addition to the flare on the planing surface. Both flares are designed with a curve to throw spray clear of the air screws.

In the hull is a 60 h. p. aero engine adapted to marine use, with shaft and water propeller leading through the aft step. In place of a standard flywheel is the armature of an electric generator for power for starting motors, the lighting system and for an electric capstan, which is mounted in the bow inside the hull for the handling of a 125-lb. anchor. This engine also drives the bilge pump for pumping the 26 water tight compartments. There are two watertight transverse bulkheads and sleeping quarters for five. Of course, a water rudder.

On top of the hull is a streamline superstructure carried just above the middle wing, divided into three compartments, as chart room and the c. o., a central one for two pilots with dual control, and a rear one for a gunner.

The hull is typical Supermarine design, of plywood, with no flat surfaces. The planning surfaces are built on to the hull and act as a double bottom. There are two steps.

The triplane wing structure, including the engine mounts, is built as a unit and is mounted on the hull at three points, with fittings of such a nature that, when necessary to dock the craft, it may go alongside the aircraft carrier or dock and have the complete wing unit lifted off by a crane, in which case it becomes a normal motor boat. The bottom wing is of plywood, while the middle and top wings are of standard construction. The lower wing has a water clearance of about 10 feet. Controls of normal type. The general overall dimensions of the wings are: Spread, lower wing, 46 ft; middle and top wings about 54 ft.; length about 30 ft.; height above water level about 25 ft.; estimated total wing area about 1200 sq. ft.

The power plant consists of two Rolls-Royce "Condors" boosted to 900 h. p. each. The gross weight, with torpedoes, full crew and fuel, is about 21,000 lbs., for 300 miles radius, though the boat is designed to take on fuel for 1000 miles.

Two 3000-lb. torpedoes are to be carried, one suspended under each lower wing root and, for these a new releasing gear has been devised.

Five machine guns are to be mounted, one on a ring directly in the nose of the hull, one a ring directly in the tail planes, which are of biplane construction, and three on a single yoke in the rear end of a superstructure built up between the hull and the bottom plane and the middleplane in such a position that the gunner can fire over the top wings. This triple gun yoke is of entirely new design in the general shape of a heart, with the point directed aft, the two loads being carried well over the side and allowing the gunner to fire straight down from either side.

The Stream Tunnel

By Dr. Michael Watter, Curtiss Aeroplane & Motor Corporation

THE attention of everyone interested in aeronautical research is attracted by the news of the successful use in the wind tunnels of mediums other than air at normal pressure. These new wind tunnels have many advantages from an aeronautical point of view but have one big disadvantage, the lack of economy, which cannot be disregarded.

One of the most important aims in Engineering is economy. We have spent too much in the last ten years and an engineer must seriously consider it. The question of economy is of prime importance in aviation. The war gave a very powerful impulse to aeronautical developments but there was one thing which the war did not require and that was economy. As a result, one of the most costly branches of industry nowadays is aeronautics. In aeronautics itself, research is handicapped by the necessity of wind tunnels, the operation of which is rather expensive. Special research requiring large values of *Ve* can be carried out by very few concerns or institutions on account of the lack of facilities.

The desire of economy and the possibility of obtaining the *Ve* effect, gave the writer an idea of the possibility of using a water-tunnel with a natural source of supply. The prime mover would be replaced by gravity. These new stream tunnels demanding almost the same equipment as an ordinary water turbine. The natural water sources and different falls could be employed for these tunnels. Some of these sources would offer a possibility for the erection of a giant stream tunnel, the actual cost of operation would be comparatively small.

The advantages of such a stream tunnel would be,

1. Economy.
2. The possibility of getting *Ve* effect.
3. More natural conditions of flow.
4. The possibility of easy visualisation of flow.

Of course it is very probable that the erection and operation of a stream tunnel would raise some technical difficulties but the writer believes that a detailed study and investigation of this question will help overcome these difficulties.

Flying Between Canada and the United States

General Situation

Canada is a party to the International Convention on Air Navigation and has passed regulations (Air Regulations 1920) governing the conditions under which flying may be carried out within and from Canadian territory. These regulations are essentials in conformity with the terms of the International Convention for Air Navigation.

The United States has not ratified this Convention and has, so far, passed no legislation dealing with the control of aeronautics, nor has it taken steps to authorize any regulating body with such control. Until such a body is created it will not be possible to negotiate an agreement with the United States Government in regard to inter-state flying between the two countries.

Pending the negotiations of such an agreement, as it was desired to grant machines and pilots of United States nationality every facility for flying within this country, the Air Board passed on May 17th, 1920, an amendment to the Air Regulations in the following terms:—

(a) That pending the organization of a body in the United States of America having authority to issue civil certificates to air personnel and until the first of November, 1921, qualified American military pilots be excepted from the provision of Para. 33 of the Air Regulations, 1920, so far as is necessary to put them in the same position with regard to flying in Canada as if they were the holders of certificates from the Government of the United States, that is, in the same position of being entitled to fly United States aircraft in Canada, but not to carry passengers or goods for hire, and

(b) That pending the organization in the United States of a body having authority to issue Registration Certificates for aircraft and until the first day of November, 1921, aircraft which would under the convention relating to International Air Navigation be registerable in the United States of America, be excepted from the provisions of Para. 3 of the Air Regulations, 1920, provided that:—

(a) Full particulars of the aircraft are furnished.

(b) The aircraft is marked in accordance with the regulations with a nationality and registration mark of which the first letter is the letter "N" and the second letter is the letter "C".

(c) If such aircraft is one which under the Regulations would require a certificate of airworthiness, a temporary certificate of airworthiness is issued.

(d) In all cases the same fees are paid as in the case of Canadian aircraft.

The Controller of Civil Aviation is to be authorized to administer this exception to the Regulations.

The effect of these regulations was to place aircraft and pilots of United States nationality in the same position as they would have been had that country enacted similar regulations to those existing in Canada.

General Procedure

When an American machine or pilot wishes to cross the International boundary and fly in Canada, notification should be sent, in advance, to the Secretary of the Air Board, Ottawa, giving the date of the proposed flight; the owner's name and address; the pilot's name and qualifications; the type of machine to be used; the route and duration of the proposed flight and the purpose for which it is being undertaken.

Military Aircraft

In the case of Military aircraft (see para. 124 Canadian Air Regulations) notification should be sent, as above, by the proper Military (or Naval) authorities, giving the above particulars and asking that permission should be granted. The officer in charge of the machine should notify the Air Board on his first landing and last departure, and must report to Customs on arrival and departure.

Commercial Aircraft

When a Commercial aircraft wishes to enter Canadian territory, the owner should make application (as in Para. III) in advance, forwarding at the same time a copy of the pilot's graduation or discharge certificate from the United States army or naval service and two passport photographs of the pilot. As there is no authority issuing pilots certificates, other than the Army and Naval Air Services in the United States, and the great majority of pilots had served in either of these services during the War, it was decided to limit the privilege to pilots who had taken the course of training in these services. Exceptions are made in favour of civilian pilots who can produce proof of qualifications equal to those necessary to obtain a pilot's certificate in Canada.

Application for registration of the aircraft, in accordance with the terms of the International Convention, must also be made and the registration markings must be painted on the machines. The Underwriters' Laboratories, it is understood, are allotting registration marks in accordance with the Convention, and their numbers are accepted in Canada. If a machine is not registered with them, the markings are allotted by the Air Board, in all cases commencing with the letters N-C. Full particulars of aircraft must be forwarded with the application for registration. Should the machine be of a type which has not yet been granted a certificate of airworthiness, an investigation of its design is made. If it is found to comply in all essentials with the standards approved in Canada, a type certificate is issued. If, on the other hand it is below the standard called for in Canadian machines, permission is refused to fly it in Canada. The registration fee is $5.00. The fee for a "type certificate" of airworthiness for an individual machine $5.00. Aircraft, engine, and journey log books should be carried on all machines entering Canada.

No commercial operations of any nature are permitted within Canada by United States machines, but they may carry goods or passengers from a point in the United States to a point in Canada, and vice versa.

Private Aircraft

In the case of Private aircraft, the pilot should forward two passport photographs of himself and a copy of his graduation or discharge certificate from the United States Air Service. The application for registration of aircraft should be made and registration markings painted on the machine in the same way as is called for in the case of commercial machines. The Secretary of the Air Board should be notified when machines enter or leave Canadian territory and Customs clearance is to be made at the port of entry and departure. A private license does not allow for flying operations for remuneration or reward to be carried out in Canadian territory, nor is it necessary for a private aircraft to be certified airworthy.

Customs Regulations

The provisions of Part 10, Air Regulations Canada 1920, in regard to reporting to the Customs authorities when entering and leaving Canada are strictly enforced. Owing to the fact that there are so few licensed Customs Airharbours in the country it has not always been possible to enforce regulations 96 calling for an initial and final landing at a Customs Harbour. Arrangements will be made when necessary to have the Customs authorities at the nearest port entry on the harbor make the necessary entries.

(Concluded from page 14)

radio telephone and telegraph. The same conditions apply to the Army and its aircraft.

Consequently we are not surprised to learn that military and naval aeronautical engineers have solved a number of highly important problems in the application of radio to air communication under very trying conditions, and that the apparatus used by the two services is in all respects available for commercial use —a very material contribution to the general welfare. All methods of sending and receiving have been refined and improved by the invention of especially sensitive apparatus unaffected by the vibrations and noises constant in aircraft under power in the air. Once it was necessary to shut off the engine to use the radio telephone while flying, this had been made unnecessary. Not only that, but the Navy has perfected a radio sending outfit which has been named the "Teletype", and which receives a message from a flying plane and writes it on a typewriter as fast as it comes in! The list of new inventions and improvements to older apparatus which is directly chargeable to radio research and experimentation by the Navy's Bureau of Aeronautics is too long to find a place here; suffice to say that results in this one department alone will repay the Nation for all the appropriations under the title "Aeronautical Experimentation."

AERIAL AGE

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Wadsworth Bill Should Pass

THE enactment during the present session of Congress of the Wadsworth bill (S. 3076), establishing a Bureau of Civil Aeronautics in the Department of Commerce, and providing for the regulation and encouragement of flying, is being urged by practically all legitimate flying organizations, including the manufacturers and responsible operators of aircraft.

This bill was introduced by Senator Wadsworth on Aug. 24, 1921, as a result of a conference with Secretary of Commerce Hoover, participated in by representatives of civilian bodies and Governmental agencies concerned, held on July 18, 1921. The bill passed the Senate on Feb. 15 of this year, and on introduction in the House of Representatives was referred to the Committee on Interstate and Foreign Commerce.

In the last nine months the measure has languished in the hands of the committee, of which Representative Samuel E. Winslow of Massachusetts is Chairman. Advocates of its passage say that immediate action will permit some sort of regulation and encouragement to be effected by next spring. Another flying season will pass unguided and uncontrolled, it is pointed out, if the bill is further delayed.

Show Accident Record

Representatives of the Aero Club of America, the Manufacturers' Aircraft Association, National Aircraft Underwriters' Association and the Society of Automotive Engineers attended the conference with Secretary Hoover. At his request the Manufacturers Aircraft Association and later the Aeronautical Chamber of Commerce conducted a survey of hazard in unregulated flight.

The report to Secretary Hoover said:

"It is estimated that, during the calendar year 1921, 1,200 aircraft were engaged in civil flying in the United States, and that these flew 6,500,000 miles, and carried 250,000 persons. These figures are approximate and include both the itinerant and fixed base flying.

"Not including those that involved Government-owned aircraft, 114 accidents occurred. The 114 accidents resulted in death to forty-nine persons and injury, more or less serious, to eighty-nine. The forty-nine lives were lost in thirty-three accidents, and injury to the eighty-nine persons was caused in but forty-two accidents.

"Each of the 114 accidents recorded was caused by deficiency in one or more of the six necessary requisites for safe flying. Forty-nine were attributed to the pilot, perhaps, through carelessness, perhaps incompetence, perhaps bad judgment combined with other factors. * * * Therefore at the very top of the list of Governmental needs we place the Federal examination and licensing of pilots.

Want Inspection Rules

"Equal in importance with learning the qualifications of pilot and navigator is inspection of aircraft and engines. Out of the 114 accidents, 22 may be attributed to faults which proper inspection probably would have revealed—four concerning the plane, nine the engine and nine an accessory, gas or oil. This inspection must be made at frequent intervals by Federal authority.

"When it is remembered that operators of motor cars are required to qualify and that motor cars are periodically placed under rigid inspection, it is astonishing to learn that any one can take any sort of flying machine into the air at the present time, with the consequent peril not only to himself and his passengers, but to many persons on the ground. If the standard of control were left to the various States the hope of correcting this unfortunate condition would seem remote."

The report cited accidents due to lack of adequate landing fields, lack of weather reports, stunting in the air, and crowds surging into the field. Only Federal rules rigidly enforced could meet these conditions, it was stated. The need of Federal authority to obtain information in such cases was also emphasized.

Army Favors Bill

The bill has been indorsed, in addition to those organizations represented at the conference, by the National Aeronautic Association of the U. S. A., the Army Air Service and Air Mail Section of the Post Office Department, the Department of Commerce and the National Advisory Committee for Aeronautics.

Major General Mason Patrick, head of the Army Air Service, testifying in favor of the bill before the Senate Committee on Commerce, said commercial flying could not assume large proportions until legislation of the nature of this measure was passed.

"It will require large investments," he said, "and capitalists are shy about investing money without proper safeguards."

Senator Wadsworth in explaining the purpose of the bill, made the following statement:

"This bill is also designed to correct a curious and extraordinary situation that is developing in customs and quarantine. Smuggling of persons and goods—including liquor— is easier by air than by many other methods, and contraband flying can not be controlled except by special law with all the force of the Government behind it."

Writing on the Sky

WHEN a British airman, Captain Cyril Turner, employing a device invented by Major John Savage, of London, went up ten thousand feet on Tuesday at the noon hour and wrote on the sky the words "Hello, U. S. A.," in gigantic letters, he made all New York sit up and take notice.

Women neglected their shopping, stock brokers forgot all about the market, taxicab chauffeurs ceased to look for fares; even the traffic policemen in Fifth avenue could not make their eyes behave. For the rest of the day it was the one subject of conversation all over the town.

Although this very modern way of appealing to the eye of the public has been employed abroad, it was the first time the blue was so used on this side of the Atlantic.

Here is new work for the foes of the billboard and the poster. If the aviation corps of the Police Department have to patrol the empyrean to prevent the hanging out of signs by those without permits they will have their work cut out for them.

It will be interesting to see what the Board of Aldermen produces in the way of an ordinance to meet the situation.

Glider or Aviette

IN the midst of the enthusiasm for gliding which has been aroused during the last few months, there are already signs of a division of opinion as to whether gliding is, after all, likely to carry us much further, or whether we should not do better by devoting our energies to the evolution of a type of power-driven airplane which will fly with engines of a few horse power only. The two schools are both emphatic in their views, but we think that, as usual in such cases, the truth lies somewhere between the two extremes. We have always held that gliding can provide excellent sport, but have never shared the optimistic view that its practice will lead to the development of types of aircraft which will be commercially useful and will be able to make long trips, to a fixed time table and over given routes, by the aid of the energy in the wind only, without other motive power.

The opposite view, that gliding cannot possibly teach us anything, is, to our way of thinking, equally incorrect. Gliding can undoubtedly teach us a good deal about best wing forms, best fuselage shapes, effective controls, and so on. In other words, it provides an opportunity of carrying out, for a very small capital outlay, full-scale experiments which would, if conducted with power-driven machines, cost considerable sums of money. The machine of ultra-low power is certainly a possibility. In fact, it is possible to predict with fair accuracy, without introducing uncertain features, that a small, lightly-loaded, single-seater machine can be built which will fly level—that is to say, will just be able to remain in the air without descending—for a power expenditure of about 4 or 5 horse power. Such a low-powered machine would, however, have no reserve power for climbing, and might easily, we think, be more dangerous than a pure glider in which the pilot would know that no other power was available than that obtainable from the wind.

It has been suggested that progress might be made by fitting a very low power engine in a glider, and merely using the power when the wind dropped or when the machine got out of an ascending current. We very much doubt if such a procedure would be satisfactory. As soon as an engine is fitted the elements of an ordinary airplane are introduced, such as noise, vibration, propeller draught, etc., and it appears to us doubtful whether pilots would be able to change over from gliding to propelled flight, and *vice versa,* sufficiently quickly and at the correct instant to make such a compromise successful. The very presence of an airscrew would detract considerably from the gliding angle of the machine, and then there is the difficulty of starting the engine, should it, as would frequently happen, stop altogether while running throttled down. To re-start would mean a steep dive, with consequent loss of altitude.

To us it seems that the best policy will be to learn as much as we can from pure gliding, and then, with the knowledge thus accumulated, attack the problem of low-power flight afterwards. In that way much more is likely to be learned than if we start off straight away with "Aviettes." That it will ultimately be possible to fly at a speed of 50 or 60 m. p. h. with a power expenditure of about 10 h. p. we are quite prepared to believe, but before the really satisfactory machine can be evolved which will do this we think a thorough study of gliding and soaring should be made.

The Last of the Hydrogen Ships?

THE recent destruction at San Antonio, Texas, of the Army dirigible C-2, will probably hasten the abandonment of hydrogen and its replacement by helium in all Army and Navy airships. The fire hazard is so great in the case of hydrogen filled ships of the type now used that future military ships will be designed to employ helium as the lifting medium. This is doubtless a wise policy so far as Government-owned ships are concerned, but the high cost of helium and its lower lifting capacity are serious detriments, even though it were available in large quantities, so far as commercial dirigibles are concerned.

The other alternative, as has been pointed out before in these columns, is the development of engines for using less volatile fuels and non-inflammable fabric or other materials which will retain the hydrogen and prevent its ignition even though a flame comes in contact with the surface of the container. There is doubtless much experimental work to be done before this alternative becomes a reality, but research work in this direction is in progress, at least so far as the engine is concerned. All-metal airplanes have been constructed, but whether all-metal construction can be successfully applied in the constuction of dirigibles remains to be seen.

If this comes about competent engineers believe that hydrogen can be employed with comparative safety. On the other hand a combustible gas such as hydrogen will always increase the fire hazard as compared to a non-combustible such as helium, no matter what engine fuel or gas container is employed.

It is hard to conceive of a container which might not be ripped open, for example, in an accident similar to that which occured in the case of the C-2 when strong gusts of wind caught it as it was being taken from the hangar. From a comparatively small rupture hydrogen might issue and burn as a jet, but a large tear might easily release large volumes of gas. Hydrogen and air form a highly combustible mixture the ignition of which might easily result in an explosion of sufficient violence to wreck a ship.

No doubt the problem of safe commercial flight in lighter than air craft will ultimately be solved, but there is still much to be done before such an ideal is realized.—*Automotive Industries.*

The News of the Month

Aircraft Safety Code Committee Meets

The general meeting of the committee for the formation of the aircraft safety code was held at the Bureau of Standards, Wednesday, November 8. The meeting was opened by the Chairman, Mr. H. M. Crane, who told of the organization of the committee and the progress of the work to date. The chairmen of the five subcommittees then reported progress in the particular parts of the code assigned to them. This was followed by a general discussion as to the policy of the committee and of some of the more important provisions of the proposed code.

Work on this code has now been in progress for over a year and it is hoped to have it completed by next spring.

Some of the provisions of the code, especially those dealing with traffic rules, licensing of pilots, protection of property, etc., cover matters which are likely soon to become subjects of legislation. In this case the code will serve as a guide to administrators and will enable the governing body to frame rules which will give adequate protection to the public while permitting the free development of the industry.

Drivers of automobiles are familiar with the inconvenience and expense which has been caused by the lack of uniform laws covering the whole country, and by the unwise character of some of the earlier legislation. It is hoped to be able to avoid this difficulty in connection with aircraft by anticipating the demand for suitable regulations and making it possible to get reliable advice on the subject, and to have Federal legislation instead of local.

In the case of those parts of the code which deal primarily with the design, construction, and testing of aircraft it is not considered wise to have its provisions embodied in legislation. These provisions can be much more readily enforced by those who are interested in and familiar with the industry, as is now done in the case of professional ethics among engineers.

The development of aircraft is making very rapid progress. Practices which are unwise in the present state of the art may soon prove desirable as a result of improvements. It is therefore considered desirable to have general legislation covering the industry, but to leave the detailed application of it in the hands of a competent administrator.

In the formulation of the code each subcommittee is assigned to a certain part. They make a draft of the rules proposed, and after thorough discussion in the subcommittee these are sent out to all the members of the committee and to all those who are competent to criticise them and offer suggestions. Then they are revised, and are submitted to the committee at its next meeting for final approval.

There are five subcommittees, dealing respectively with airplane structures; engines; equipment and maintenance; lighter-than-air craft; traffic rules; signals; licensing of pilots; landing fields; etc.

The committee is sponsored by the Bureau of Standards and the Society of Automotive Engineers, who do the clerical work and coördinate the entire task. It is representative of all the important organizations in the country who are interested in aircraft.

Officers of the Committee

Chairman: H. M. Crane, 44 West 44th Street, New York City. Vice Chairman: Prof. J. S. Ames, Johns Hopkins University, Baltimore, Md. Secretary: Dr. M. G. Lloyd, Bureau of Standards, Washington, D. C. Vice Secretary: A. Halsted, Bureau of Standards, Washington, D. C.

Chairman of Subcommittees

Airplane Structures—

Prof. E. P. Warner, Massachusetts Institute of Technology, Cambridge, Mass., Representing American Society of Mechanical Engineers.

Power Plants—

Geo. J. Mead, Wright Aeronautical Corporation, Paterson, N. J., Representing Society of Automotive Engineers.

Equipment and Maintenance—

Archibald Black, 25 Brixton Road, Garden City, Long Island, Representing Society of Automotive Engineers.

Lighter-than-Air-Craft—

R. H. Upson, Aircraft Development Corporation, General Motors Building, Detroit, Michigan, Representing Society of Automotive Engineers.

Traffic Rules, Landing Fields, Pilots, Signals, Etc.—

A. Halsted, Bureau of Standards, Washington, D. C., Representing Bureau of Standards.

As all national safety codes are established under the direction of the American Engineering Standards Committee, it was felt by the initiators of the aeronautic code that the latter should be initiated by this same body.

The American Engineering Standards Committee, at its meeting of October 9, 1920, appointed a sectional committee for safety codes, with the Bureau of Standards and the S. A. E. acting as joint sponsors for that committee. The following organizations were requested to designate representatives on the sectional committee: War Dept., Navy Dept., Post Office Dept., Coast Guard, N. A. C. A., National Safety Council, Underwriters' Laboratories, National Aircraft Underwriters' Ass'n, U. S. Forest Service, Manufacturers Aircraft Ass'n, Aero Club of America, Am. Soc. Mech. Egrs., and Am. Soc. of Safety Egrs.

The Bureau of Standards and the Soc. of Automotive Engineers, acting as sponsors, prepared a complete synopsis of a safety code for aeronautics, which was distributed to the various organizations to be represented on the sectional committee.

A meeting for organization purposes was held in Washington on May 13, 1921, for consideration of scope and method of development of the code. Another meeting was held in New York, Sept. 7, at which permanent organization was effected, the officers consisting of a chairman, H. M. Crane, of the S. A. E.; vice-chairman Dr. J. S. Ames of the N. A. C. A; and secretary M. G. Lloyd, of the Bureau of Standards. Five sub-committees were appointed to deal with the subject matter, as follows: Airplane structure, including design, construction and test; power plants for aircraft, including design, construction and test; equipment and maintenance of airplanes; lighter-than-air craft; aerodromes and traffic rules, including landing fields, air ports, traffic rules and qualifications of pilots.

Germans Plan Dirigible Line Here

According to the Berlin correspondent of the New York Herald a plan for the establishment of numerous new air lines in the United States with the combined technical skill of Germany and American capital was brought back recently by Herr Schuette of the Schuette Lanz dirigible works, one of the most extensive concerns of the country during the war.

Herr Schuette declares that plans are practically perfected for the opening of a line from New York to Chicago with craft of German design having capacities of from 110,000 to 150,000 cubic meters. Working out of such craft in this country was forbidden after the war by the treaty. Hence the proposal to build and operate them in America would result both in development of American air lines, which is much desired there, and at the same time preserve German interest in continuing the development of air navigation.

Herr Schuette declared that the airships of the capacity planned for the New York-Chicago line are as small as can be built and still give satisfaction. They afford passenger space enough to make the business a paying one and give room on board for all modern comforts. The plans show restaurants, smoking rooms, sleeping and living compartments, baths and promenade decks, the speed is reckoned at 100 kilometers per hour and could be increased to 140 kilometers or about eighty-seven miles.

Herr Schuette declares that the service can easily be extended to any part of the United States if the proper repair shops and landing stages are constructed. The method he proposes would permit landings in the center of cities by overhead stages. He said that once a country with the resources and ingenuity of America takes advantage of the steps attained by the German builders, transatlantic lines would be within the realms of possibility and round the world lines would be the next development.

Until recently when at the international air convention restrictions were withdrawn flying had suffered greatly in Germany. Now, however, planes can pass over countries of Powers represented at the convention, but building of the larger types is still forbidden by rules drawn up at the conclusion of the war. Airplane lines developed greatly in Germany during the summer and, while many of them did not connect with outside lines, they did much to keep the interest of plane builders alive.

Perhaps the biggest development was the establishment of the route from Köenigsburg to Moscow. This is considered so important that it will be kept up throughout the winter while many other lines are abandoned. The London to Berlin line, just now being got into shape for operation is another big achievement of the year.

"What we have lacked heretofore," said Major von Tschudi, one of the most important figures in Germany's air activities, "was connecttions with other lines. This lack was not altogether due to political reasons. It is true that flying over some countries was forbidden, but, as in the case of the Berlin-Moscow line, the distance from Berlin to Köenigsburg was not made by air because it was considered more convenient to passengers. A number of reasons lay behind the lack of coordination among the various countries, including lack of subsidies for opening routes through territories where good connections could be made. The way is in sight now, however, for connections with the French line from Paris to Warsaw, touching Prague and Strassbourg and with the line from Breslau to Budapest via Vienna. The idea of state subsidies has been recognized by the German Government, but thus far the service has not been given great impetus by the money received.

"Good organization and connections with lines to other countries, however, combined with improved planes, will make vast improvements in coming years."

The Collier Trophy

Contenders for the Collier Trophy should present their claims in writing to the "Collier Trophy Committee, National Aeronautic Association, 26 Jackson Place, Washington, D. C." before Monday, January 1, 1923.

The Collier trophy is of bronze, and was presented by Robert J. Collier, Esq. The trophy is to be awarded annually for the greatest achievement in aviation in America, the value of which has been thoroughly demonstrated by use during the preceding year.

The first award was given to Mr. Glenn H. Curtiss for his development and demonstration of the hydroairplane during the year 1911.

The trophy for the year was again awarded to Mr. Glenn H. Curtiss for his development and thorough demonstration of the flying boat, in which buoyancy is supplied by the fuselage.

In 1913 the trophy was awarded to Mr. Orville Wright in recognition of the development and demonstration of his automatic stabilizer.

For 1914 the trophy was awarded to Mr. Elmer A. Sperry for his work in achieving the automatic control of an airplane by means of the gyroscope.

The trophy for the year 1915 was awarded to Mr. W. Starling Burgess, of Marblehead, Mass., in recognition of his development and demonstration of the Burgess-Dunne hydroairplane during the year 1915.

The trophy for 1916 was awarded to Mr. Elmer A. Sperry for the development and thorough demonstration of the Sperry Drift Set.

This trophy was not awarded during 1917 or 1918 on account of the war.

In 1921 this trophy was awarded to Mr. Grover C. Loening, for the development and demonstration of his aerial yacht.

The Collier Trophy Committee consists of: Dr. George W. Lewis, Chairman, Mr. Porter H. Adams, Mr. Maurice J. Cleary, Mr. B. Russell Shaw.

Harding Endorses Aeronautics Policy

Endorsing the National Advisory Committee for Aeronautics' plea for the fostering of aeronautics development in this country, the President has forwarded the eighth annual report of this body of scientists to Congress with the statement that:

"The constructive recommendations therein contained for the advancement of aeronautics deserve the thoughtful consideration of all members of the Congress."

In presenting the eighth annual report of the National Advisory Committee for Aeronautics to the President, Dr. Charles D. Walcott, Chairman of the Committee, points out that the contributions of the Committee to the science of aeronautics have placed America in the forefront of progressive nations in aerial navigation. "In the art of aviation there has been substantial progress in the design and performance of military and naval types of airplanes, but commercial aviation has made very little headway," he states, adding that this is due, not so much to the inherent problems and difficulties of air navigation, nor the lack of technical knowledge, as to the lack of airways, landing fields, and Federal Regulation and licensing of aircraft and operators. Calling attention that the development of world transportation both by rail and road has depended largely on governmental aid, Dr. Walcott states that aircraft will prove even more revolutionary than railroad and automobile development. "In the opinion of the National Advisory Committee for Aeronautics, he explains, "it is necessary and proper that the Federal Government should aid in the development of air navigation by providing Federal regulations and establishing airways and landing fields."

A policy for the development of aeronautics as a national asset beneficial in time of peace as well as in time of war, is outlined in the Committee's report. The relative importance of aviation in war alone is said to be of sufficient importance to justify the expenditure of public funds to aid the development of aerial navigation on a commercial basis. The history of civilized nations shows, the report states, that governments have found it necessary to aid in developing all transportation systems, and that today the progressive nations of Europe are spending large sums, through direct and indirect subsidies for the promotion of civil and commercial aviation. Without asking financial assistance for the art, the report states that the practical development of aviation in America will be realized only when this Government gives intelligent support and effective aid, principally by regulating and licensing airplanes and pilots, and with state coöperation in establishing airways and landing fields.

Briefly, the National Aeronautical Policy recommended provides that:

Aeronautics has already exerted a great influence on civilization, its necessity in military operations being definitely established, although its adaptation to commercial purposes has scarcely commenced.

Lack of restriction of aircraft development by the Limitation of Arms Conference, is believed sufficient to assure greater relative importance in future warfare on both land and sea.

Practical application of aviation in Air Mail Service within a few years, is one of the marvels of the age. Each improvement in transportation is known to have lightened man's labors, increased his prosperity and broadened his knowledge of his fellow man. The continuance of the service is recommended.

With the help of well-directed scientific research, with the imagination of the people fully aroused, and with comprehensive, helpful legislation, aeronautics will yield in peaceful pursuits its real contribution to the progress of civilization.

Scientific research in aeronautics is said to be the most important subject in the field of aerial navigation development; the Army and Naval services depend upon the work of the Committee for the solution of the more difficult problems in the fundamental art of flight, which is the prescribed function of the Committee. The urgent need for ample funds and facilities with which to complete the execution of a research program already approved, is explained.

Federal regulation of aviation, with state coöperation, is urged by the Committee, which also recommends the creation by law of a bureau of civil aeronautics under the Department of Commerce.

Although public sentiment seems to be urging the reduction of the Army and Navy to a pre-war basis, it is the judgment of the Committee that the public does not demand that the air services of those arms be so reduced, nor even that they be reduced proportionately with the other branches of the Army and Navy. The novelty of aerial warfare, the lack of civil aviation activities from which to draw in time of need, the rapid development of aeronautics in other countries, and the necessity for aviation in national defense, have led the people to support a policy of progress and development in aeronautical branches of both the Army and Navy, however much they may insist upon curtailment of other military expenditures, it is claimed.

The Committee urges the development of our helium extraction methods and the conservation of this unique supply of non-inflammable lifting gas, through the acquisition of the fields and the sealing of the wells.

The development of aerological service along transcontinental airways, when established, is requested, and the authority for the extension of this work by the Weather Bureau is urged, as without an aerological service, it is explained, there can be no safety in the air nor progress in commercial aviation.

Colonel Lahm and the N. A. A.

Colonel Frank P. Lahm, with the Army Air Service and one of the oldest American fliers, with a distinguished war service, has been appointed Chairman of the Contest Committee of the National Aeronautic Association of U. S. A.

Owing to the importance of this committee which has charge of the American Pulitzer Races and all other contests, sports and aeronautic races in this country, and which furnishes Officers to observe and authenticate all aeronautic records not only in the United States but in connection with the Fédération Aéronautic Internationale, the world-governing association for the homologation of aeronautical sport and contest records, it was necessary for the National Aeronautic Association to place at the head of this committee the most competent man available in the country. It is therefore, a recognition of Colonel Lahm's qualifications that he was selected to head this vital committee, the activities of which are of immense importance to the development of aeronautics in America. It is through sports and contests properly regulated and controlled that peak performances are obtained which point the way to aeronautical engineers and manufacturers engaged in forward looking programs of aeronautic research, experiment, manufacture, and operation.

Colonel Lahm is now on duty at the office of the Chief of Air Service, Washington, D. C. He is a graduate of West Point Military Academy and began his duties in connection with aeronautics in France in September and October, 1906, where he won the first Gordon-Bennett Balloon Race at Paris; he was next in charge of the Wright Airplane tests at Fort Meyer, Va., 1908-1909; was winner of the National Balloon Race at St. Louis in 1911, and organized the Army Air Service in the Philippine Islands in 1912. During the war he was at Headquarters A. E. F. and Headquarters, Air Service of Advance, October 1, 1917 to July 26, 1918; with Headquarters, First Army, A. E. F. from that date to October 12, 1918 and thereafter until April, 1919, commanded the Air Service, Second Army, A. E. F.

Colonel Lahm is a military aviator, holds American License No. 3, Spherical balloon pilot; American License No. 2, dirigible balloon pilot; American Aviator's Certificate No. 2 for airplane pilot; and American Expert's Certificate No. 15, for airplane pilot.

Colonel Lahm has already begun work on the details of the Pulitzer races to be held in 1923.

Pioneer Instrument Company

The Pioneer Instrument Company announces that they have purchased the entire aircraft instrument business of the Lawrence Sperry Aircraft Company, and have acquired an exclusive license under their aircraft instrument patents. Licenses under certain patents of the Sperry Gyroscope Company have also been secured.

The Lawrence Sperry Aircraft Company will continue its manufacture of airplanes. They have a modern and well-equipped plant at Farmingdale, L. I., with an adjoining flying field.

The manufacture of both SPERRY and PIONEER aircraft instruments will now be handled exclusively by the Pioneer Company.

Young Discusses European Situation

Recent record performances of American airplanes have spurred on the European nations to unprecedented effort in aviation, according to W. C. Young, manager of the Aeronautics Department of the Goodyear Tire and Rubber Company, and a Governor of the Aeronautical Chamber of Commerce, who returned recently from an investigation of the aeronautical situation in England, France, Germany and Spain. He said that every effort is being made in both England and France to produce new aircraft capable of outflying American products in speed and performance.

"Germany today ranks first among the nations in all-metal construction," said Mr. Young. "France is building many new types of airplanes, seeking machines with low operating cost such as economy in fuel consumption coupled with high performance. England has been working hard to develop fast ships; and France is now building new long distance commercial types.

"Spain learned a lesson during the Moroccan campaign; and has adopted an aviation policy calculated to develop both her military and commercial air power. Both airplanes and airships will be employed. Spain is convinced that the lighter-than-air craft has an immediate future; and is planning to employ the dirigible and the smaller non-rigid ships in maintaining a patrol of her frontiers, as well as linking up with South American countries commercially. Germany so far leads the world in the construction of the great rigid airships of the Zeppelin type. I think, however, that small non-rigid airships built in the United States are unsurpassed in any European country."

Air Law Survey

Forty countries have national air laws regulating the operation of civilian aircraft and designed to decrease flying accidents due to reckless piloting, according to a survey which the Aeronautical Chamber of Commerce of America has forwarded to the Department of Commerce.

"Twenty-six nations which ratified the International Air Convention drawn up following the Armistice, have established national legislation providing for safe and sane flying within their own borders," the Chamber finds. "Fourteen other nations have various kinds of national air laws.

"Of the remaining countries on earth, those which have not yet passed air laws tending to safeguard the passengers and the lives and property of the public, include Abyssynia, Persia, Bhutan, Nepal, Oman and the United States.

"All aviation organizations have co-operated in urging the passage of the Wadsworth Bill providing for a bureau of civilian aeronautics in the Department of Commerce. The measure, if it became a law, would regulate all civilian flying, provide penalties for reckless pilots and purveyors of unsafe machines and would prescribe means for protecting property on the ground.

"It passed the Senate last February. The House as yet has taken no action."

Comparative Strength of Air-Dried and Kiln-Dried Wood

Some wood users claim that kiln-dried wood is brash and not equal in strength to wood that is air-dried. Others advance figures purporting to show that kiln-dried wood is much stronger than air-dried. But some 150,000 comparative strength tests, made by the Forest Products Laboratory, of the U. S. Forest Service, on kiln-dried and air-dried specimens of 28 common species of wood show that good kiln drying and good air drying have the same effect upon the strength of wood.

The belief that kiln drying produces stronger wood than air drying is usually the result of failure to consider differences in moisture content. The moisture content of wood on leaving the kiln is generally from 2 to 6 per cent lower than that of thoroughly air-dried stock. Since wood rapidly increases in strength with loss of moisture, higher strength values may be obtained from kiln-dried than from air-dried wood. Such a difference in strength has no significance, since in use a piece of wood will come to practically the same moisture condition whether it is kiln-dried or air-dried.

It must be emphasized that the appearance of the dried wood is not a reliable criterion of the effect the drying process has had upon its strength. The strength properties may be seriously injured without visible damage to the wood. Also, it has been found that the same kiln-drying process can not be applied with equal success to all species. To insure uninjured kiln-dried material, a knowledge of the correct kiln conditions to use with stock of a given species, grade, and thickness, and a record showing that no more severe treatment has been employed, are necessary.

Chicago-Seattle Air Mail

Chambers of Commerce in nearly every community between Chicago and Seattle are working hard to secure an air mail service between the two cities.

A Good Performance

Walter Beach, Chief Pilot for the E. M. Laird Company, Wichita, Kansas, recently completed a remarkable trip covering 2,229 miles by air. He was aloft thirty-two hours. Straight flying from Wichita to Detroit, which was one of Beach's objectives, by way of Chicago and return is 1,718 miles. Side trips were made to Mt. Clemens, Toledo, Minneapolis, Fort Dodge, Red Oak, Forest Park and other towns.

London Newspapers by Air

37.4 tons of newspapers are carried from London to the continent every month—an average of more than a ton daily. Newspapers represent about one-half the total cargo of the British, French and Dutch aircraft.

Possibilities in Mexico

William G. Shauffler, Jr. returned recently from a business trip in Mexico where he reports unusual opportunities existing for the development of air transport. He has an interesting proposition where two types of planes may be required; (1) two passenger small machines, capable of a quick getaway with full load at 7,800 feet above sea level. (2) cargo planes carrying reasonable pay loads. Interested persons are advised to communicate with him, care L. V. D., 349 Madison Ave., New York City.

Automobile and Gas Engine Encyclopedia

The new edition of Dyke's Automobile Encyclopedia is ready! Inasmuch as the old edition was considered one of the best practical handbooks for drivers, repairmen and students seeking to fit themselves as automobile mechanics, the later volume will receive a sure welcome.

Included in the 1238 pages are the answers to nearly every problem and question that may come up in your work or studies regarding the mechanism of an automobile. Starting motors, generators, universal joints, electrical parts, etc. are thoroughly treated.

In order that the reader may be informed before he passes the ignition or the other electrical subjects, the elementary principles of electricity and magnetism are presented. Also a complete diagnosis of all possible electrical troubles is given.

There's a handy index of 14,000 captions which makes it possible to quickly get to the right page or the necessary diagram. With over 4000 illustrations intelligently explained and a dictionary of motoring terms, the new edition should be of real worth to every one in the industry who needs a book to "stand at his right hand" and answer questions when, as and if required.

The book may be secured from Goodheart-Willcox Company, Inc., of Chicago; $6.00 for the cloth bound copy and $7.50 for flexible morocco.

Personal Par

Mr. H. Barber, F. R. Ae. S. the well-known Aeronautical Consultant and Underwriter, announces that Mr. Robert H. Baldwin is now associated with him in business at 30 East 42nd Street, New York. Mr. Baldwin has had some ten years experience in insurance and banking and, during the war, qualified as an artillery air observer and saw considerable active service in France.

New Publications of National Advisory Committee for Aeronautics

In accordance with the policy of *Aerial Age* of indicating to readers all sources of information on every subject connected with aeronautics, it is printing from time to time lists of reports, notes and the like which are available to the public from Government sources. Following is a list of several new Reports of the N. A. C. A. A complete list of those published heretofore was printed in the November number.

No. 145. Internal Stresses in Laminated Construction. 10c.

No. 150, Pressure Distribution over Thick Aerofoils—Model Tests. 5c.

No. 152. The Aerodynamic Properties of Thick Aerofoils II. 5c.

No.153. Controllability and Maneuverability of Airplanes. 5c.

The above may be purchased at the price noted by money order or cash from Superintendent of Documents, Government Printing Office, Washington, D. C.

Airships Incorporated

The Airship Manufacturing Company of America has been incorporated under the name of "Airships Incorporated."

Charles C. Witmer and Beckwith Havens were the partners operating under the name of the Airship Manufacturing Company of America.

"Airships Incorporated" is incorporated by Charles C. Whitmer, Beckwith Havens and James F. Boyle, these three being the only stockholders. The policies and organization of The Airship Manufacturing Company of America will be in no way affected by this change.

All contracts now in hand will be finished by The Airship Manufacturing Company of America but all new business will be taken on in the name of "Airships Incorporated."

The Officers of "Airships Incorporated" are as follows: President, Charles C. Witmer; Vice Pres., Beckwith Havens; Sec. & Treas., James F. Boyle.

Orville Wright and Gliding

In order to foster and encourage Glider Contests in the United States, the National Aeronautic Association of U. S. A. has appointed a subcommittee to investigate and report on Glider Contests, suitable locations, and times of the year in which Glider Contests may be successfully conducted, and to furnish data to interested persons who desire to compete in such contests.

The Chairman of this committee is Orville Wright, who nineteen years ago, made the first flight in a mechanically propelled "heavier-than air" machine.

Mr. Wright will be assisted in his labors by the following members of the committee: Dr. George W. Lewis, Executive Secretary of the National Advisory Committee for Aeronautics; Professor E. P. Warner, in charge of Aeronautical Department at the Massachusetts Institute of Technology; Mr. E. T. Allen, of Massachusetts Institute of Technology, who took the M. I. T. Glider abroad last summer in the French and German Glider Contests; and, B. Russel Shaw.

Mr. Shaw is the Executive Vice-Chairman of the Contest Committee of the National Aeronautic Association, and states that the sub-committee represents the best qualified aeronautical experts in this country to carry out the duties involved.

Mr. Wright himself, has had much experience in Gliding, the successful design of the Wright Brothers' first airplane, being largely due to data and experienced gained from gliding. Mr. Wright's record for hovering over one spot, has never been equalled, although more than 20 years have elapsed since the Kitty Hawk exhibition. Professor Warner is one of the world's greatest aerodynamic engineers and was a witness to the German and French Glider Contests of this year, while Mr. Allen was the Pilot of the Glider that Professor Warner designed.

Loening to Study Air Lines in Europe

Grover Loening, the aeroplane constructor who built the Air Yachts used last summer around New York City and Newport by Harold S. Vanderbilt, Vincent Astor and others, sailed recently for Europe.

In connection with projects now being studied for air lines next summer from New York to Newport, Southampton and other nearby resorts, Mr. Loening will make an investigation of the organization and equipment used on several European Air Lines, studying the French, English and German methods and their latest developments.

ARMY and NAVY AERONAUTICS

Secretary of the Navy Reports

The Secretary of the Navy in his annual report to Congress discusses Naval aeronautics as follows:

"The development of aviation as an integral part of the fleet, with types of aircraft suited to every need of the naval forces, has been the outstanding feature of the past year in naval aeronautics. The rapid strides that have been made in organization and development work have fully justified the establishment of the Bureau of Aeronautics, and the work of this bureau is also reflected in the general contribution that has been made to the advancement of industrial and commercial aviation in this country.

"The catapulting of a service type seaplane from the deck of the U. S. S. *Maryland* is a forerunner of providing aerial defense to every type of surface ship, and the catapult developed by the Navy will find a wide commercial application in the future. The conversion of two battle cruisers under construction into aircraft carriers has been recently authorized by Congress, and may be cited as the most progressive step yet taken to place aircraft with the fleet. The production of helium gas from July to November of 1921, at the United States helium production plant No. 1, was a help to lighter-than-air development, and preceded the first flight in the history of the world of an airship filled with helium gas—that of the C-7 from the naval air station, Hampton Roads, Va., to Washington, D. C., and return.

"The construction of fleet airship *No. 1* at the naval air station, Lakehurst, N. J., is estimated at more than 60 per cent complete, and contracts have been signed for acquisition by the United States of a 70,000 cubic meter airship to be delivered by the German Government on reparations account. The importance of airship development by the Navy will be felt in commercial and industrial enterprise.

"The successful development of torpedo-carrying seaplanes and of ship planes, and the commissioning of our first airplane carrier, the *Langley*, are also outstanding features of the year.

"These and other aeronautical accomplishments brought to a successful conclusion during the past year, have been consummated, in conformity with the aviation policy enunciated in my last year's report, to place an adequate air force in the fleet as an integral part of it, and to operate with it at any time, wherever it may be."

The Navy Spotting Plane

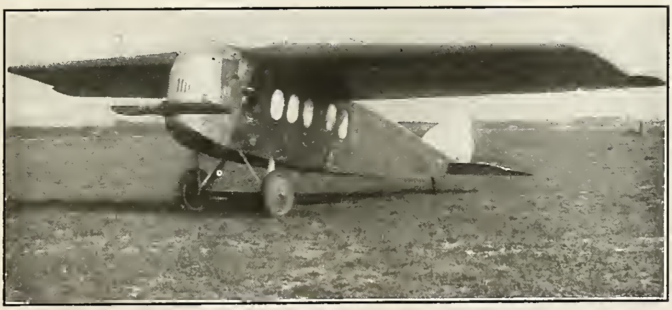
To direct the fire of battleships from the air a new type of plane designed under Navy specifications has been undergoing test by a trial board during the past week and according to opinions of experts in the Bureau of Aeronautics of the Navy Department gives every promise of success.

The new plane will be in effect a battleship mast ten thousand feet high in that it will enable the observer to witness the effect of big gun fire from this altitude and communicate his observations by radio to the firing ship. The plane is known in official parlance as the MO-1. It is a three seater monoplane with an all metal frame construction of aluminum alloy and is designed for spotting and for short distance reconnaissance work.

The spotting plane is a post war development in naval aviation and is a product of the policy of fitting aircraft to the needs of the Navy. Airplane spotting as a practical method of fire control has been thoroughly worked out in target practices held by the battleships during the past two years but the planes used for the purpose were adaptations of existing types and were not altogether suited to the service requirements. The MO, Martin Observation, has been specially designed to become an integral part of the fire control organization of the modern battleship and as such will have an important bearing on the accuracy of naval gunnery.

The new plane was built at Cleveland by the Glenn L. Martin Company, builders of the widely known Martin Bomber and official tests have been under way at the builder's plant. The development of a spotting plane is another step in the way of providing aircraft specially equipped and specially suited to naval requirements. Prior to the war little more was expected or required of planes than that they fly. During the war the tendency was toward the development of bombing and scouting planes to combat the submarine menace, but since the Armistice the needs of the Navy in aviation have been the subject of careful study which has resulted in a specialized development of types. This was reflected in the F-5-L scouting planes, the recently developed Douglas torpedo planes, the TS combat planes, and now the three seater spotter. The new planes will be equipped with a 350 H. P. Curtis engine.

To suit the varied conditions under which a naval plane must operate the MO is designed for interchangeable landing gear, which will make it adaptable for landing and taking off from the deck of an airplane carrier, or in place of wheels for landing and taking off, pontoons may be substituted which will permit of landing and taking off from water. The plane is also designed to be quickly assembled and knocked down for stowage in a small space, a feature that will make it particularly suited to conditions on shipboard. The all metal



New Navy Spotting Plane which will be used to control Ship Fire.

conducted by the Bureau of Aeronautics in the use of duralumin for aircraft building and established a practice which will be of incalculable benefit to the aircraft industry in this country.

Spotting of gunfire from the air marks a new epoch in modern gunnery. Heretofore and from time immemorial the fall of shots on an enemy target were observed from the mast head of the ships and the accuracy of fire was communicated to the gunners by the observers. With the adaptation of aircraft to spotting the observer now hovers over the line of fire and the panorama of the naval battle is spread out below him. Estimates of distances can be made with the greatest accuracy. The information thus obtained is quickly and accurately communicated to the firing ships by radio installation in the plane and developments in this line, which have kept pace with aviation, enable a well nigh perfect communication system to be maintained.

Official Report of Endurance of Lieuts. Kelly and Macready

Complying with orders from the Chief of Air Service, the Army Air Service Transport T-2 left McCook Field, Dayton, Ohio, for Rockwell Field, San Diego, Calif., on Sept. 19, 1922, for the purpose of making a transcontinental non-stop flight from San Diego to New York, carrying as pilots 1st Lieuts. Oakley G. Kelly and John A. Macready, and as mechanicians, Charles Dworack and Clyde Reitz.

Stops were made en route at Scott Field, Belleville, Ill.; Fort Sill, Lawton, Okla.; and Fort Bliss, El Paso, Texas.

The first leg of the flight to San Diego from McCook Field to Scott Field, 320 miles, was made without especial incident, although rain and clouds were encountered between Terre Haute, Ind., and St. Louis. Lieut. Macready piloted the ship on this trip. The 320 miles were flown in 4 hours at an average speed of 80 miles per hour. Owing to the fact that both tachometers failed, it was impossible to note the R. P. M. It is believed that this was close to 1500.

The airplane was serviced at Belleville with 125 gallons of gasoline and 9 gallons of oil. Sept. 20th was spent at Scott Field, rain, low clouds and fog making the visibility too poor to attempt flight with the Transport, although the engine was warmed up ready for a take-off at 4:30 a. m. The next day was still very cloudy with low fog. A reconnaissance flight in a DH was made toward Springfield, Mo., by the two pilots, as a result of which it was deemed advisable to take off for Lawton, Okla., at 11:30 a. m., although weather conditions were not good. The visibility over the Ozark Mountains to Springfield, Mo., was poor. Clouds were below the mountain tops in many places and the ceiling was less than 500 feet. Clear conditions existed west of Springfield. Lieut. Kelly piloted the plane.

A landing was made at Fort Sill at 5:45 p. m., after covering 550 miles in 5 hours and 46 minutes, an average speed of approximately 100 miles per hour at 1440 r. p. m. This excellent average was primarily due to a favorable wind. Powerful searchlights were thrown on the plane and the work of preparing for the next morning's flight was accomplished at night. The officers and personnel at Fort Sill co-operated to the fullest extent.

The take-off for El Paso was made the next morning at 8:05 a. m., Lieut. Macready pilot. A due west compass course was flown for 270 miles to a point north of Farwell, Texas, and then southwest 100 miles to Roswell, N. M.

It was intended to fly a straight compass course through a pass in the Sacramento Mountains between Roswell, N. M., and El Paso, Texas, but due to extremely rough and bumpy air over barren, jagged peaks for over 100 miles, and the fact that this pass, 7500 feet elevation, was higher than the ceiling of the airplane with the heavy load, it was found impossible to cross the mountains at the intended point. This was the most difficult point of the entire journey. The most efficient climb and the best altitude could not be gained, as the extreme roughness and bumpiness of the air would jar and raise the carburetor float causing the engine to cut out or entirely cease operation for short periods with a resultant loss of altitude just at the time an unusually rough peak threatened to swipe off the landing gear or wing tips.

For the first 100 miles of this leg of the journey there was a favorable east wind which changed to a strong south wind for the ensuing 170 miles and then due to the change in direction of flight from west to southwest at Farwell, Texas, it was necessary to "buck" a head wind for 230 miles.

Considerable anxiety was caused both pilots and crew by the rapidly decreasing gasoline supply and the fact that the sylphon gasoline pump was now leaking due to an internal crack in the first lower left sylphon, which was continually pumping a spray of gasoline from the drain.

A landing was made at Fort Bliss at 3:35 p. m. covering the 550 miles in 7 hours, 30 minutes, at an average of 73.3 miles per hour.

Saturday, Sept. 24th, the sylphon pump was removed and found to be cracked. Although a wire had been sent for a new sylphon pump upon landing the day before, it was decided to repair this pump by soldering and continue the flight to San Diego. The repair work was completed, the pump installed and the airplane serviced with 190 gallons of gasoline and 7 gallons of oil.

Due to the high altitude of the flying field at Fort Bliss (3800 feet) it was decided to allow Mr. Dworack and Mr. Reitz to proceed by rail to San Diego. They proceeded via Southern Pacific Railroad that evening at 10:05. The load was thus reduced by approximately 500 pounds, practically all of the baggage being transferred by rail from this point.

The airplane left Fort Bliss on Sunday at 6:48 a. m., with a total weight of approximately 7500 pounds. No trouble was encountered in the take-off, while a climb to 2,000 above ground level was made in 16 minutes. The vicinity of the airdrome was left at 6:55 a. m. Deming, N. M., 80 miles, was passed at 7:45; Lordsburg, N. M., 140 miles, at 8:18; Bowie, Arizona, 190 miles, at 8:45; Tucson, Arizona, 290 miles, at 9:45: The Southern Pacific Railroad was followed to Tucson, but from Tucson to Yuma an airline course passing just south of Ajo, Ariz., was chosen. This 220 miles was made in 2½ hours during which time no available landing field was sighted and not a sign of life was observed. This country is almost entirely composed of rough, rugged volcanic peaks, with apparently no life or vegetation existing.

San Diego was reached at 2:10 p. m. The 650 miles were covered in 7 hours, 15 minutes, at an average speed of approximately 90 miles per hour. Sixty-six gallons of gasoline and nine gallons of oil were drained.

Mr. Dworack and Mr. Reitz arrived Monday, Sept. 25th, at 7:20 a. m. Arrangements were made with the Commanding Officer, Rockwell Air Intermediate Depot, regarding the necessary assistance, including labor and material to install a new engine and prepare the airplane in general for the coming non-stop transcontinental flight. After arranging these details the flying field was inspected by driving across at various angles and carefully measuring each course by the speedometer. It was found that a run way of one and seven-tenths miles was available in the direction of the prevailing wind. As the flying field had been inactive for several years, a certain amount of work was necessary to prepare this as an ideal take-off, due to the clumps of bunch grass and sandy soil.

The Commanding Officer, McCook Field, was wired requesting the sub-allotment of $300 to cover the payment of civilian labor necessary for this work, and upon receipt of authority work on the runaway was commenced the following morning.

Summarizing the flight from McCook Field to Rockwell Field, a distance of 2,070 miles was covered in 24 hours, 31 minutes. The average ground speed was 83.7 miles per hour, the gasoline consumption 586 gallons, and the average fuel consumption per hour, approximately 24 gallons.

A Standard Liberty-12, 400 h. p., McCook Field, overhauled engine was used, with the following accessories:

- Modified Zenith Carburetor, Venturi Tube,
- 36 M. M. Metering Jets flow Main 39) pts. Comp. 95.5)
- Standard oil pump with oil radiator.
- Mosler M-1 Spark Plugs.
- Delco 8 volt ignition with special 8 volt generator cut out and standard 8 volt regulator.
- Two 8 volt ignition batteries.
- Sylphon gasoline pump.
- The usual nose radiator with 3 expansion relief valve assisted by a booster radiator furnished adequate cooling.
- Four gallons extra water was carried in a nurse tank with means of injecting same to the intake side of the water pump.

Testing Anti-Aircraft Batteries

Lieuts. L. F. Post (pilot) and B. R. Dallas (observer) recently made a night flight in conjunction with a training problem of the anti-aircraft batteries at Fort Scott, San Francisco Bay, played tag between the many beams of the search lights, and appeared to be able to dodge the gunners on the ground at will. The night flights in the vicinity of San Francisco are much enjoyed by the populace in general as well as those at Crissy Field.

Transporting Airplane Engines by Plane

While returning from the Detroit races in General Patrick's new plane, Majors Dargue and Pirie experienced a forced landing in the vicinity of Buffalo, N. Y. A message was directed to the Aberdeen Proving Grounds, Md., requesting that a new motor be dispatched to Buffalo. Same arrived in less than 24 hours. The transporting of a Liberty motor over such a distance as this is not a common occurrence. The center section of a Mark 20 Bomb Rack was removed from an NBS-1, and the motor loaded in the fuselage. Taking off from Aberdeen at 9:30 in the morning, Lieuts. George and Bleakley flew to Buffalo and made the trip in about five hours, a stop for service being made at Middletown, Pa.

Border to Border Non-Stop Flight Postponed

Lieut. Leland S. Andrews, who had contemplated making a non-stop flight from the Mexican to the Canadian border in the plane piloted by Lieut. Doolittle on his recent transcontinental flight, was recently discharged from the Base Hospital at Fort Sam Houston, Texas. He is very much disappointed in having to postpone his border to border trip, but must bow to the will of the Flight Surgeon, who is of the opinion that Lt. Andrews' physical condition is not such as to warrant his making the attempt just at this time.

The ever increasing value of aerial mapping work is forcefully brought to our attention each time a report is received covering such operations. The Engineering Division, McCook Field, Dayton, Ohio, has just submitted a report covering the operations of a photographic mapping expedition to the State of Tennessee, which was directed by Captain A. W. Stevens of the Aerial Photographic Branch of the Engineering Division, with Lieut. George W. Polk as pilot.

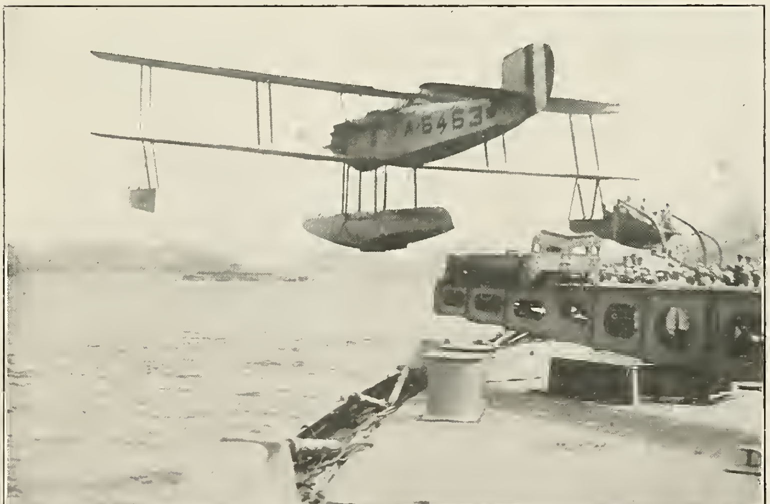
During the course of two months Captain Stevens exposed, developed, numbered, plotted, and printed negatives covering 5,000 square miles of the State. A flying field was selected near Tiptonville, Tennessee, and a laboratory set up in the village. From this point as a base, photographic work was carried out in the northwestern, southwestern, and central parts of the State.

The region known as the Reelfoot Lake area, which comprises 630 square miles and extends from the foothills on the east to and including the Mississippi River on the west, was photographed first. Two photographs were made of it, one from an altitude of 15,000 feet with a K-1 camera fitted with a 12-inch lens. The other was made from an altitude of 16,000 feet with a Tri-Lens camera, using 6½ and 7½-inch lenses. Ammonized panchromatic film was used entirely, with ray filters which excluded blue rays altogether and thereby eliminated the effects of aerial haze.

An area of 1300 miles, embracing the Mississippi River from New Madrid, Missouri, south to the Tennessee-Mississippi State Line, was next flown over and photographed, the F-1 camera being used.

The third area was that of the Memphis Quadrangle, which was photographed twice from an altitude of 16,000 feet. The T-1 camera was used in making the first photograph, and the K-3 camera in making the second.

(Concluded on page 37)



The latest in Naval Aviation demonstrated at Rio de Janeiro at the Brazilian Exposition. Seaplane being launched from the U. S. S. Nevada

REVIEW of WORLD AERONAUTICS

UNIFIED AIR SERVICE PROPOSED IN ITALY

General G. Douhet, who is in a position corresponding to our Chief of Staff, is urging the creation of a Central Air Bureau, headed by a civilian.

Under his plan, the War and Navy departments will still have the responsibility of the employment of the Army and Navy air services, which are integral parts of the Army and Navy and provided for in the respective appropriations, the Army and Navy to determine the quality and quantity of aircraft and equipment necessary and to assume responsibility for its employment.

To this extent, the Air Department is limited in its functions to merely a supply organization for material and personnel against reimbursement of expense. The Air Department also bears the same relation to any other department which may use aircraft.

This Central Aeronautical Bureau will have direct supervision of civil aeronautics and of the Independent Air Force, which can act independently from the Army and Navy.

In fixing the appropriation for the C. A. B., sums will be set aside for the development of civil aeronautics and for the creation and development of the Independent Air Force, the third branch of the national defense power.

In operation, the C. A. B. would have two main divisions, the one charged with the supply, from private industry, of all the materials of the quality and quantity needed by the various departments and by the I. A. F.; and the other charged with the supply, from private initiative, of trained personnel, according to the requirements of the various departments and by the I. A. F.

It is planned that the Government do away with all that does not belong to it or else entrust it to private concerns, leaving freedom for private initiative. The proponents believe this organization can operate with the minimum of offices, officials and paper work.

New "Air" Members in the Commons

Many candidates who have been elected to the new British Parliament are, or have been, interested or closely associated with aviation—amongst these we notice, and welcome back to his seat, Sir William Joynson-Hicks; also Lieut.-Col. J. T. C. Moore-Brabazon, Admiral M. F. Sueter, and Maj.-Gen. Sir F. Sykes. Possibly a good omen for the future of air matters is the fact that Sir Samuel Hoare, Minister for Air was the first Minister returned whilst Sir J. L. Baird, who was a member of the Air Board for the Royal Air Force, appropriately as an air supporter, represents "Ayr" in the House, and it may be noted for this same constituency the labour candidate, who was defeated, was named Airlie. Many other supporters and well-wishers of aviation are welcome members, including: Capt. W. Brass, a distinguished R.A.F. officer; Comdr. Burney of Imperial Airship fame; Capt. Wedgewood Benn; Rt. Hon. Lord Hugh Cecil (R.F.C. 1915); Capt. A.G. Reid, R.A.F., D.F.C., Capt. D. Shipwright (R. F. C. 1916); Sir John Simon (R. F. C. 1915-16); Maj. G. C. Tyron (Under Secretary for Air, 1919), etc.

India's Air Command

As the result of Air Vice-Marshall Salmond's visit to India, the air command in India has been raised to the dignity of an Air Vice-Marshal's command. Air Vice-Marshal P. W. Game has been appointed to the post in the place of the present commander, Air-Commodore Tom I. Webb-Bowen, air officer commanding R.A.F. in India. The headquarters of the Indian Air establishment will be transferred from Umballa to Delhi.

Pilotless Plane Safe from Enemy Control

Pilotless bomb-carrying airplanes controlled by wireless will be the most dangerous weapon in future wars, says the French inventor of wireless instruments, Branly, who insists that French apparatus has been developed to such a point already that it is impossible for enemy wireless experts to interfere with control. Not only would an enemy be obliged to know every secret wave length used, but the French controls under experiment were so delicate that special and intricate signals could be so sent as to operate directly many small parts of mechanism.

"As a result," says Branly, "the enemy would have to have full knowledge of the mechanism used, and this can be changed every time the plane leaves the aerodrome; and stolen secret codes henceforth will be useless. Of course, parasite waves could be sent out in all directions, which might make our control more difficult, but under such conditions the enemy would be interfering with his own wireless also."

Commercial Airplane Flies 100,000 Miles

When the Daimler air express G-Ebbs arrived in London from Manchester a few days ago it achieved a new commercial aviation distance record, having completed 100,000 miles of flying.

The machine is the first airplane to fly this distance. During its long career the machine carried thousands of passengers. At present it is working on the Manchester-London-Berlin route.

Imperial Air Mail Survey

The civil Aviation Advisory Board of the British Air Ministry in July 1922 submitted to Parliament a complete survey on Imperial air mail services and their possibilities. It is proposed to have several services linking up an air line to India, by means of privately operated companies sufficiently subsidized to insure a small percentage on capital invested.

International Aero Exhibition and Contests at Gothenburg, Sweden

We have received requests from officials of the Gothenburg exhibition for co-operation in securing representation of aerial products from the United States.

The Exhibition will open at 12 o'clock noon on Friday, July 20th and close on Sunday, August 12th, 1923. The Exhibition grounds will be open from 10 a. m. to 8 p.m. daily and all articles exhibited must remain on view during these hours. The Exhibition will be held in Gothenburg on the open space known as Exercisheden, which has an area of 120,000 sq. metres and, in addition to a number of smaller buildings, a large Exhibition Hall will be erected with a floor space of 9,650 sq. metres.

The rates for space for respective groups are:

In American currency and measure approximately calculated with an average rate of exchange: $1 =3,00 Swed. Kronor.

for group	A to C	..about	.54pr. sq. ft.
" "	F to K	.. "	.98 " " "
" "	D to E	.. "	$1.22 " " "

Offices: 61c pr. sq. foot.

N.B. All payments shall be effected in Swedish currency.

Definite applications for space must be in the hands of the Board on or before January 1st, 1923. Applications must be made upon a prescribed form, in accordance with the regulations issued by the Board and shall contain a full description of the proposed exhibit, and no alterations shall be made in respect of the object or objects exhibited without the permission of the Board. The Board reserves to itself the right to refuse any application. Copies of the program may be obtained from the Aeronautical Chamber of America. For detailed information communicate with Mr. Thorsten Gerle, Director General of Posts, Stockholm, Sweden.

Modification of Government Subsidy to British Air Lines

The British Air Ministry, with the concurrence of the Lords Commissioners of His Majesty's Treasury, has decided to modify the system under which subsidies are at present granted to approved firms for the operation of the Cross-Channel routes.

Three approved British companies—Handley Page Transport, Ltd.; Instone Air Line; and Daimler Hire, Ltd.—have operated services under the existing system which provided for the grant of a subsidy of 25% on an "approved" firm's gross earnings and additional payments per passenger carried and per pound of goods and mails transported, as well as certain contributions towards the provision and insurance of aircraft, subject to the fact that the total contribution either in cash or in kind should not exceed £200,000 per annum. Each of these firms was authorized to run London-Paris services and the Instone Air Line also received approval to inaugurate a London-Brussels service. In addition, a company in formation by the Supermarine Aviation Works, Ltd., was approved for operation of the Southampton, Cherbourg and Channel Islands route, but this service has not yet been opened.

It has now been found that the total payments under the subsidy scheme are insufficient to provide the companies with the necessary measure of financial assistance, and for some time past alternative proposals have been under consideration. An analysis of the situation showed that the volume of traffic, both on the London-Paris route and the London-Brussels route, has not been forthcoming to the extent which had been anticipated on the evidence of previous years' operations, despite the fact that British companies have secured on the London-Paris route the greater proportion of all classes of traffic.

The new scheme provides for the elimination of the present competition between British firms by the allocation of a separate route to each company. The basis on which the subsidy (which is still limited to the sum of £200,000 per annum) will be given is a limited cash payment for the completion of a stipulated number of flights and a contribution in cash or in kind towards the maintenance of a fleet of approved size and value. The routes to be operated under the new scheme will be:

London-Paris by Handley Page Transport Ltd.

London-Brussels-Cologne by Instone Air Line.

London-Amsterdam-Bremen-Berlin by the Daimler Hire Ltd. (subject to further negotiation).

Southampton-Cherbourg and Channel Islands by a new company. (not to be opened till next spring).

The approximate lengths of the different routes are London-Paris 225 miles; London-Brussels-Cologne, 310 miles; London-Berlin, 570 miles; and Southampton-Cherbourg-Channel Islands, 120 miles. The number of routes operated and the mileage flown by British firms will therefore be greatly increased.

Flying Fire Fighters

Manitoba is the first province in Canada to rely solely upon the flying service for the protection of its forests, says Consul General Brittain, Winnipeg, in a report received by the Department of Commerce. One 10-passenger flying boat has been dispatched to The Pas, about 350 miles northwest of Winnipeg, and it will shortly be joined by three others. Four additional machines will eventually be stationed at Victoria Beach, on the eastern shore of Victoria Lake.

Besides patrolling the forests of the province and adjoining territory, the flying boats will be used for conveying agents of the Dominion Indian Department and survey parties to their posts. It is also the intention of officials to carry mail and make aerial photographs of the country from the aeroplanes.

Aviator Poet

Everybody is likely to be interested in the new edition of Jimmy Howcroft's poems, which, under the title "LOOKING ON" is now issued by the author.

Howcroft is an Airman who was desperately wounded during the war. Since 1916 he has been unable to move hand or foot; indeed it is a mystery to his doctors that he should be able to live since his spine is fractured. He is in constant pain.

Howcroft, however, has the poet's ability to rise superior to his surroundings, and most of the poems in this little volume were dictated to his nurse in The London Hospital where he was looked after for five years.

Howcroft now lives at Liphook, in a cottage, in comfort, largely owing to the tangible result of the first edition of this book. With his wonderful enthusiasm he is now very keen on starting a poultry farm, and he is looking to future sales to start him in this scheme.

These verses serve to show us there are no circumstances, however adverse, which a courageous spirit may not surmount. There must be many who, admiring this war hero's sustained courage, will be glad to help in the small way of securing this little book of poems, which has proved itself of help to many on account of its outlook of cheerfulness and courage. This second edition much augmented, revised, and a new photograph added, can be obtained from the author at Little Forest Cottage, Liphook, Hants; at the low price of 2/6d. post free or by the kindness of Messrs. Eden Fisher & Co. Ltd., from them at 95 Fenchurch Street, E.C.3.

The Field Lighting System at Le Bourget

Air travelers from London and Continental points locate the aerodrome at Le Bourget by Barbier & Besnard electric searchlight with shutters. This has a range of 120 miles, lighting all the azimuths from the horizon to the zenith. The light signals the Morse "N" (—.) every eight seconds. The light is mounted on a *pylon* about 98 feet high.

The direction from which the wind is blowing in indicated by a luminous "T" wind vane. The airplane alights parallel to the long axis of the "T".

A circle of 82 feet diameter, formed in colored electric lights, illuminated either in green or red as desired. This serves to indicate the direction in which to land according to the rules of the field. Green signifies "Turn to the right;" red says "Turn to the left." Finally, a Greek cross is illuminated to allow or refuse landing. Red advises "Do not land"; green indicates "Authorization to land."

Obstacles are all indicated by red lights. Four large beacons which, during the day, indicate the limits of the field, carry at night powerful red lights. The buildings as well as the radio poles and searchlight pylon are indicated by columns of red lights. The landing field, therefore, appears as a dark spot framed by a series of red lights. Unexpected obstacles on the ground, such as damaged aircraft or vehicles, are surrounded with red lights.

When the airplane has been given the word to alight, there is lighted a group of B. & N. projectors carried on a truck to the most convenient part of the ground, according to the wind direction. These projectors light the ground horizontally over an approximately rectangular area. The intensity of the light is such that one can easily read a newspaper on a dark night a thousand feet or more from the truck. The group of lights is so placed that the pilot landing in the wind is lighted from the side.

To further avoid any misunderstanding as to the direction in which to land, a row of white lamps 60 feet long placed in the direction of the wind, is run from the truck which is itself indicated by a red light. The pilot must alight parallel to this row of lights, from the first white light toward the red light.

Navy's Giant Airship Design Approved

Experts of National Advisory Committee for Aeronautics Give ZR-1 "OK"

ALL elements of design and construction of the Navy's Fleet Airship No. 1, better known as the ZR-1, have been approved by a special committee of engineers and experts appointed by the National Advisory Committee for Aeronautics at the request of the Naval Bureau of Aeronautics. Work of assembly, now well under way, will be completed by July 1, 1923, it is now estimated by the Naval constructors.

It is agreed by the committee members that all available airship information has been applied in the ZR-1 designs and that the Naval engineers have used good judgment throughout. The basing of the fundamental design on the successful German Zeppelin L-49 has also found favor in the eyes of the investigators, who not only checked the plans and specifications but have tested the materials used and 200 full-sized girders for strength. Carefully outlined and detailed tests of the 680-foot airship upon her completion, as provided by the Naval engineers, have also been endorsed by the National Advisory Committee for Aeronautics as a safety precaution.

The Special ZR-1 Committee

Dr. Henry Goldmark, a well-known consulting engineer of New York, heads the special committee, which includes the following engineering and aeronautical experts: Prof. William Hovgaard of Boston, director of warship design at Massachusetts Institute of Technology, and internationally recognized as the foremost authority on the structural strength of ships; Dr. L. B. Tuckerman, physicist of the Bureau of Standards; Dr. Max M. Munk, aeronautical expert of the National Advisory Committee for Aeronautics, and Prof. W. Watters Pagon of the Civil Engineering Department of Johns Hopkins University, Baltimore, Md. For practically five months since its first meeting in June, which was called to order by Rear Admiral D. W. Taylor, U. S. N., the committee has been studying and checking the plans of the airship holding in all fifteen full meetings.

The Navy's Airship

Briefly the specifications for the Naval Airship call for a rigid craft built of duralumin trusses and girders, containing twenty separate gas bags totaling 2,155,200 cubic feet, and covered with a single envelope. Her total length is 680 feet and her diameter is 78 feet. Six separate cars are suspended from her keel each carrying a 300 HP Packard aircraft engine.

The rigid airship selected as a prototype for the ZR-1, the L-49, embodies the experience obtained in the construction and operation of 100 successful airships through a period of ten years, the report states. Calculations for the Navy's aircraft were fuller and made in greater detail than any specifications for similar craft on record, the committee reports, explaining that its own conclusions were reached after studying all elements of ZR-1's design and construction. A special study of methods used in computing the stresses and aerodynamic forces acting on the craft in flight were gone into and the committee is of the opinion that the methods followed in the ZR-1 designs are sufficiently accurate.

Only One Airship Failure

A study of the records of rigid airships built in the past, revealed the fact that the only known case of a disastrous accident due to structural failure in flight was that of the British airship R-38, also known as the "ZR-2", although the reasons for the failure have not, in the opinion of the committee, been definitely determined. Although the structural designs were not similar, the committee compared the plans of the ZR-1 with those of the R-38 from every point of view and finds that the ZR-1 is "measurably stronger". Possible causes for failure of rigid airships other than structural weaknesses were considered by the committee in its investigations with the result that the members feel that careful provision in the design of the Navy's airship has been made to guard against them.

Although the ZR-1 which is being constructed at Lakehurst, N. J. will probably be structurally complete by the end of the fiscal year, Naval experts say that progress from that day on will be very slow, due to the many tests and experiments to be conducted before she takes the air. All the twenty gas-containers, for example, must be tested for leakage and lift. In fact every part must be individually tested before the first trial flights with instruments to record all pressures that are made. The prescribed program of scientific tests and trials will be rigidly followed before the great craft of the air goes into active service, and this the committee believes will furnish great additional assurance of successful service. This was the purpose of Admiral Moffet, Chief of the Naval Bureau of Aeronautics, in asking the National Advisory Committee to undertake the checking of the Navy's plans in detail, he did not want a repetition of the disaster which occurred during the tests of the R-38, which was to have become the United States Navy's first large airship.

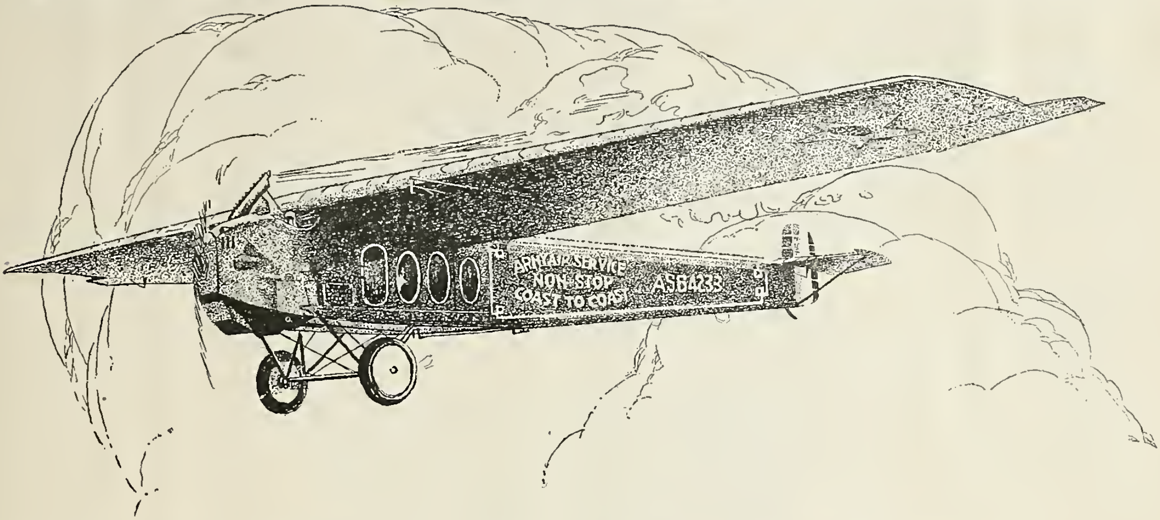
Air Industry To Pay Tribute on Basic Radio Patent

ANOTHER pioneer in the aircraft development is to receive his reward for invention. As commercial flying comes to pass and inter-city aircraft routes are inaugurated, radio equipment will be an immediate necessity.

If the Government has made no mistake in accepting his invention as basic and in paying $75,000 for a license, commercial users will likewise recompense Harry M. Horton, whom many early birds will remember for his first public demonstration of radio sending from an aircraft in flight.

"Another chapter, in aerial achievement is recorded in the sending of this wireless message from an aeroplane in flight" was the message broadcasted by John A. D. McCurdy from his 4-cylinder Curtiss pusher at the Sheepshead Bay meet in August, 1910.

The sending apparatus was secured in the machine just behind the pilot's seat and it weighed about 25 pounds. It was designed by Mr. Horton, previously an expert with the De Forest Company. When the trial was about to be made, McCurdy was handed this message by F. D. Caruthers, of the *World*. It was received by an outfit placed in the grandstand.



A Superb Effort and a Record!

On the morning of November 3rd, the giant Army-Fokker Monoplane T2 took off from Rockwell Field at San Diego. The Atlantic Seaboard was her goal.

Two hours later a water-jacket cracked—Old Man Luck had taken a hand. But Lieutenants John A. Macready and Oakley G. Kelly determined to push on.

For more than twenty-four hours they fought against terrific odds. As the water leaked out, canned soup, milk, and coffee were poured into the radiator.

Early next morning the engine became so hot that the plane threatened to catch fire. To push on was suicide. So, at 9:50 A. M., the T2 landed at Schoen Field, Indiana, her engine burned out.

A superb effort! And in making this effort the T2 broke all previous records for a non-stop flight—2060 miles were covered in 27 hr. 56 min.

We count it an honor that the T2 was Valsparred.

CONTRACTORS TO U. S AND FOREIGN GOVERNMENTS

CABLE ADDRESS: FOKPLANES
CODE: A. B. C. 5TH. ED.

FOKKER AIRCRAFT

PHONE: LONGACRE 6927

N. V. NEDERLANDSCHE VLIEGTUIGENFABRIEK
AMSTERDAM (HOLLAND) ROKIN 84

NETHERLANDS AIRCRAFT MANUFACTURING CO.
286 FIFTH AVENUE NEW YORK

ANTHONY H. G. FOKKER, PRESIDENT

Valentine & Co.
364 Manhattan Ave.
Brooklyn, N. Y.

November 17, 1922

Gentlemen:

In reply to your inquiry we wish to say that we have found Valspar to be in every respect excellent. It is used on practically all of the Fokker commercial aeroplanes which are in use on the European air lines. The machines which we have flown in this country have been exposed to extremely unfavorable weather conditions in the open, but we have found that the veneer covered wings with an extra coat of Valspar are entirely unaffected, even when they have been covered with snow for several weeks.

It is evident that our factory in Holland thinks the same of Valspar as we do here as, with some of the machines that came over, they even sent some cans of it for use here.

The Fokker F4 monoplane with which the United States Army Air Service recently made a World's Duration Record Flight of 35 hours 18 minutes at San Diego, and later made a record non-stop flight under extremely bad weather conditions from San Diego to Indianapolis in 25 hours, was also finished with Valspar.

Very truly yours,

RN: HM NETHERLANDS AIRCRAFT MFG. CO.

R.N.C. Yonday

VALENTINE'S
VALSPAR
The Varnish That Won't Turn White

VALENTINE & COMPANY
Largest Manufacturers of High-grade Varnishes in the World
ESTABLISHED 1832
New York Chicago Boston Toronto
London Paris Amsterdam
W. P. FULLER & Co., Pacific Coast

(*Concluded from Page 19*)

ful searchlight, arranged so that its rays point directly upwards, will be sufficient. Quite some varied equipment has been, and is being, tried out and much could be written on this end of the subject, but any attempt to cover it completely here would require more space than can be given in this article.

Tables:

1. Complete list of air station maintenance and general equipment with some approximate costs.
2. Complete list of air station servicing equipment with some approximate costs.
3. Complete list of air station operating equipment with some approximate costs.

Illustrations:

1. Oil and gasoline barrel rack.
2. 5-gallon safety gasoline or oil can. (McNutt)
3. Oil and water heating system.
4. Tail skid towing and handling dolly.
5. Wheel chock.
6. Flying boat (HS-2-L) handling truck for hard surfaced runways.
7. Odier portable (compressed air) engine starter.
8. Wind cone.
9. Aldis landing signalling light.
10. Floodlight battery for night landings.
11. Pintsch landing ground-light system.

Table 1—Complete list of air station maintenance and general equipment (with some approximate costs as of August, 1922.)

Hand fire extinguishers.
$10.00 to $30.00 less discount of 10% to 33% according to type and quantity.

Fire engine.
40-gal., foam, $350.00. 80-gal., foam $1100.00. 70-gal., soda-and-acid $900.00

Fire gong or siren.
10" signal gong, hand operated, $5.00.

Heating system.
Variable.

Electric power unit. (where necessary)
Range from $250.00 for 300-watt set to $1395.00 for 2½-kilowatt set.

- Tractor with flat wheels.
Fordson with special wheels, $588.00.

- Grass cutter attachment.
$120.00.

- Road drag attachment.
$91.50.

- Snow plow or broom.
Rotary broom attachment, $400.00.

- Roller attachment.
24" diam. x 6'-0" long, $170.00.

Light truck.
Ford with stake body and cab, $665.00.

Desk, chairs, files, typewriter and miscellaneous office furniture.
Variable.

Automobile jack and garage small tools.
Variable.

- Indicates required for land stations only.

Table 2—Complete list of air station servicing equipment (with some approximate costs as of August, 1922)

Gasoline storage tank with measuring pump.
550-gal., system $200.00 to $310.00 installed. 10,500-gal., system $900.00 installed.

Oil barrel rack or tank and pump.
2-drum rack about $15.00 to $20.00.

Portable oil tank with measuring pump.
65-gallon, one compartment, $150.00.
65-gallon, two compartment, $215.00.

Safety gasoline and oil can.
5 gallon cans, $5.00 to $7.50.

Self-closing waste can.
From $3.25 for 12"x15" to $14.00 for 24"x36".

Water storage system. (where no running supply)
Cost very variable. For small supply, portable, 50-gal., steel barrels $10.00 up.

Tire pump.
Automobile hand or foot type $2.50 to $5.00.

Oil and water heater.
Makeshift system, $40.00 to $70.00. Complete system, $200.00 to $225.00.

Battery charging set.
Improvised set using existing power supply and resistances, about $10.00 up.

Clothes and tool lockers.
Built at station.

Tarpaulin covers.
Variable.

Towing and mooring ropes.
½" $2.50, ¾" $5.00, 1" $8.00 per 100 ft., manilla.

- Handling dolly.
Varies with materials on hand. Possibly $35.00 to $50.00.

- Mooring rings or stakes.
Nominal.

- Engine starter.
No quotations.

- Wheel chocks.
$10.00 to $15.00 per set of two.

* Handling truck
Average size probably $40.00 to $50.00.

* Mooring buoys.
Small galv. iron $5.00, cork $10.00 to $15.00.

* Anchors.
Small, $5.00 to $20.00.

* Beaching tracks or runway.
Variable.

* Crab, capstain, or crawler tractor for hauling out.
Crabs, $68.00 to $128.00 according to capacity. Small winches, $20.00 to $25.00.

* Small power boat with service gasoline tank, etc.
Subject to great variation. 30-ft., boat with 12-h.p. engine probably about $800.00. Second-hand, about $400.00 up.

- Indicates required for land station only.

* Indicates required for water station only.

Table 3—Complete list of air station operating equipment (with some approximate costs as of August, 1922)

Wind cone or automatic Tee.
Wind cone $15.00 to $20.00 without mast.

Signal tower or platform.
Variable.

Megaphone.
Hand type $1.50 up.

Signal flags or semaphore.
Plain hand flags $1.00 each up. Semaphore variable.

Signal lights or flares.
10-min. red ground flares $3.00 dozen. 1-min. high power white flares $1.00 each.

Radio telephone or telegraph.
Very variable. Complete inside and outside apparatus, 50-100 miles telephone range, $4390.00. Same for 150-300 miles telephone range, $5540.00. Telegraph range about three times the above.

Landing floodlights.
Variable.

Landing ground-lights.
Variable.

Obstacle lights.
Variable.

Beacon lights.
Variable.

Rain gauge.
Jar type, $6.50. Self-measuring type, $40.00.

Anemometer.
High or low speed, $50.00. (Both probably required.)

Barograph or barometer.
Barograph, $45.00 to $60.00. Barometer, $20.00 up.

Thermograph or thermometer.
Thermograph, $55.00. Thermometer $10.00 up.

(*Continued from page 38*)

Dihedral both wings	4°
Stabilizer area	7 sq. ft.
Elevator area	5 sq. ft.
Fin area	3 sq. ft.
Rudder area	3 sq. ft.
Aileron area each	6 sq. ft.
Weight empty	370 lbs.
Weight loaded (full load)	570 lbs.
Load per sq. ft.	5.7 lbs.
Load per. H. P. (28)	20 lbs.
Maximum Speed	90 M. P. H.
Minimum speed	40 M. P. H.
Engine, Lawrence 2 cyl.	28 H. P.
Propeller,	5½'. dia. with 5½' pitch
Propeller speed	1500 R. P. M.

Aeronautical Engineering Society

The Aeronautical Engineering Society of the Massachusetts Institute of Technology, which built and flew the only glider representing the United States at the International Gliding Contest in France during the past summer, held its first meeting of the term on Wednesday, Nov. 15.

Otto C. Koppen '23, and Harry C. Karcher '25, members of the M. I. T. glider team, spoke on their experiences in taking the glider to France and flying it in the contest. This was the first opportunity for the society to hear at first hand an account of the facts from the men who actually managed the undertaking.

Prof. E. P. Warner '17, who toured Europe last summer making a study of aeronautics abroad, gave a talk on the gliding contests, illustrated with lantern slides and motion pictures of the French and German competitions and the M. I. T. glider in flight. He emphasized the fact that the M. I. T. glider was not only designed and constructed for the contest in a remarkably short length of time, but was shipped to France and the first machine in action of the fifty gliders in the competition. He pointed out also that up to the time the M. I. T. glider was put out of commission by an accident which was no fault of the machine or pilot, its total time in the air was three times as great as that of all other competitors combined.

The Aeronautical Engineering Society is holding a competition for the design of a glider, in which all M. I. T. students will be eligible to submit designs, and the winner will be awarded a suitable trophy. It has not been decided whether the society will construct another glider this year, but it hopes to continue to encourage and advance the science of gliding and soaring flight as far as possible.

Apathy in India

According to the American Consul at Karachi, India (Avra M. Warren), apathy on the part of the traveling public, as well as government inertia, and the long time and distance required to import machines and parts have combined to restrain the development of civil aviation in India. With the exception of a few sport planes maintained by Indian princes, there is no commercial, passenger, or mail service; continuous flying is limited to the activities of the six squadrons of the Royal Air Force, situated at strategic points along the Northwest frontier. These squadrons are dependent for supplies, maintenance, and repair on the Karachi depot, from 800 to 2,000 miles distant.

General flying practice is in favor of the light bombing plane with an American motor, as combining to a maximum degree the safest, fastest, and steadiest flying qualities for general utility. Advantage of superior power, double ignition, direct drive, clean design, and easy disassembling has brought the American engine into general use.

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WANTED—New 6 cyl. Anzani 50 H. P. motor. Please address replies to Box 691, c/o Aerial Age, 5942 Grand Central Terminal, New York City.

FOR SALE—Model A Hispano 150 H. P. $250.00, 220 H. P. geared Hispano $200.00. OX5 Curtiss $125.00. All fine condition. Curtiss M. F. boat with model A Hispano $875.00. L. W. F. tractor less power $300.00. Nels J. Nelson, 513 East St., New Britain, Conn.

FOR SALE—Following aeroplanes ready to fly; Thomas-Morse Scout (new) OX5 motor, $600.00. French Spad Scout, 220 H.P. Hispano motor (new) $400.00. Hiendrick Scout OX5 motor, $800.00. Standard J-1 (new) OX6 motor, $1000.00. E. J. Bond, 609 Main St., Houston, Tex.

WANTED—Three new Standards ready for OX5's, F. O. B. storage point, price must be right. Also good pilot wishes position. Ardie Miller, 632 W. Main St., Benton, Ill.

FOR SALE—New M. F. flying boat, 3 seater, with new 100 H.P. OXX6 motor installed, ship completely tuned up and ready for flight $1200.00. Address Box 685, c/o Aerial Age, 5942 Grand Central Terminal, New York City.

PROPELLERS—New OX5 Flottorp copper- tipp, Hispano, Liberty, Curtiss Navy, etc. Single $10.00 each. Lots of 25 $4.00 each. Parachute $50.00. Moore, 60 Richfield Ave., Buffalo, New York.

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STANDARD NEW MOTOR delivered 500 miles free $700.00. Jennies new $850.00. Wilde's Airplane Co., Charlottesville, Va.

CURTISS SEAGULL—Equipped with C-6 motor, used about twenty hours; mechanically perfect; looks like new. Price reasonable. Inquire Owner, 1308 Marine Trust Bldg., Buffalo, N. Y.

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$800.00.JN4 plane worth $1200.00. Will trade for good car or seaplane. Arthur Caron, 47 Bremer St., Manchester, N. H.

FOR SALE—3 place Laird Swallow airplane. Practically new—used 12 hours. Set up in Chicago ready to fly. Cash price $1850. Lee Hammond, 341 E. Ohio St., Chicago.

OX5 PROPELLERS, radiators, Zenith car- buretors $12.00 each. Shock cord 3c ft. Axles $2.00; landing gear struts $1.75 each; wing struts $1.50. Wing covers $10.00; propellers pullers $2.00; propeller hubs $4.00; new OX5 motors for sale or trade; dope 5 gal. $6.00. Everything new. Canuck in perfect condition $650.00. North Central Aviation Co., Marceline, Mo. R. W. Shrock Mgr.

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FOR SALE—Must and will sell at a bargain the following Curtiss Orioles K6 motors, Curtiss Mountain Oriole K6. Jennies, spare K6 and OX motors, complete list of parts. Everything A1 shape guaranteed. Muskogee Aircraft Co., Muskogee, Okla.

FOR SALE—Rumpler C4 five passenger aeroplane with extra motor and two extra sets wings unassembled $1500.00. New Standard J1 with 180 H.P. Hsso ready to fly away $1500.00. Standard J1 good as new with 160 Mercedes unassembled $1000.00. OXX6 motor $200.00. Hispano Suiza motor 180 H.P. magnetos and carburetors $400.00 each. O. W. Pearson, Jr., Troy, Ohio.

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PRICED FOR IMMEDIATE SALE—Standard J1, 3 passenger equipped with 150 H.P. Hispano motor just top overhauled, excellent condition. Total motor time 32 hours. Mahogany instrument boards in both cockpits. Plane in daily operation at our airdrome. Will refinish to suit customer. Must be seen to be appreciated. Price $1500.00 complete. R. S. Fogg, Concord Aircraft Co., Concord, N. H.

FOR SALE—New Flying Boat, 2-seater, has mahogany planked hull, new OXX6 motor and double dep. control. Will sell for less than half cost for cash. Herbert Wacker, R. R. No. 4. Mt. Clemens, Mich.

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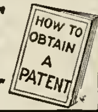

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The Air Mail An Economic Necessity

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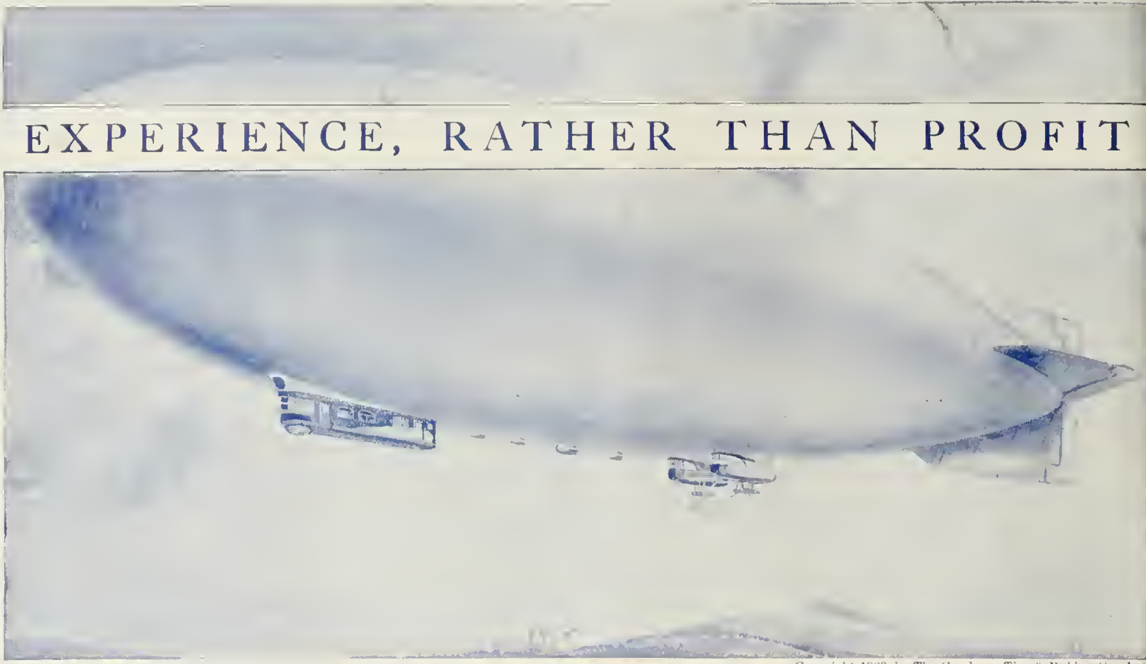

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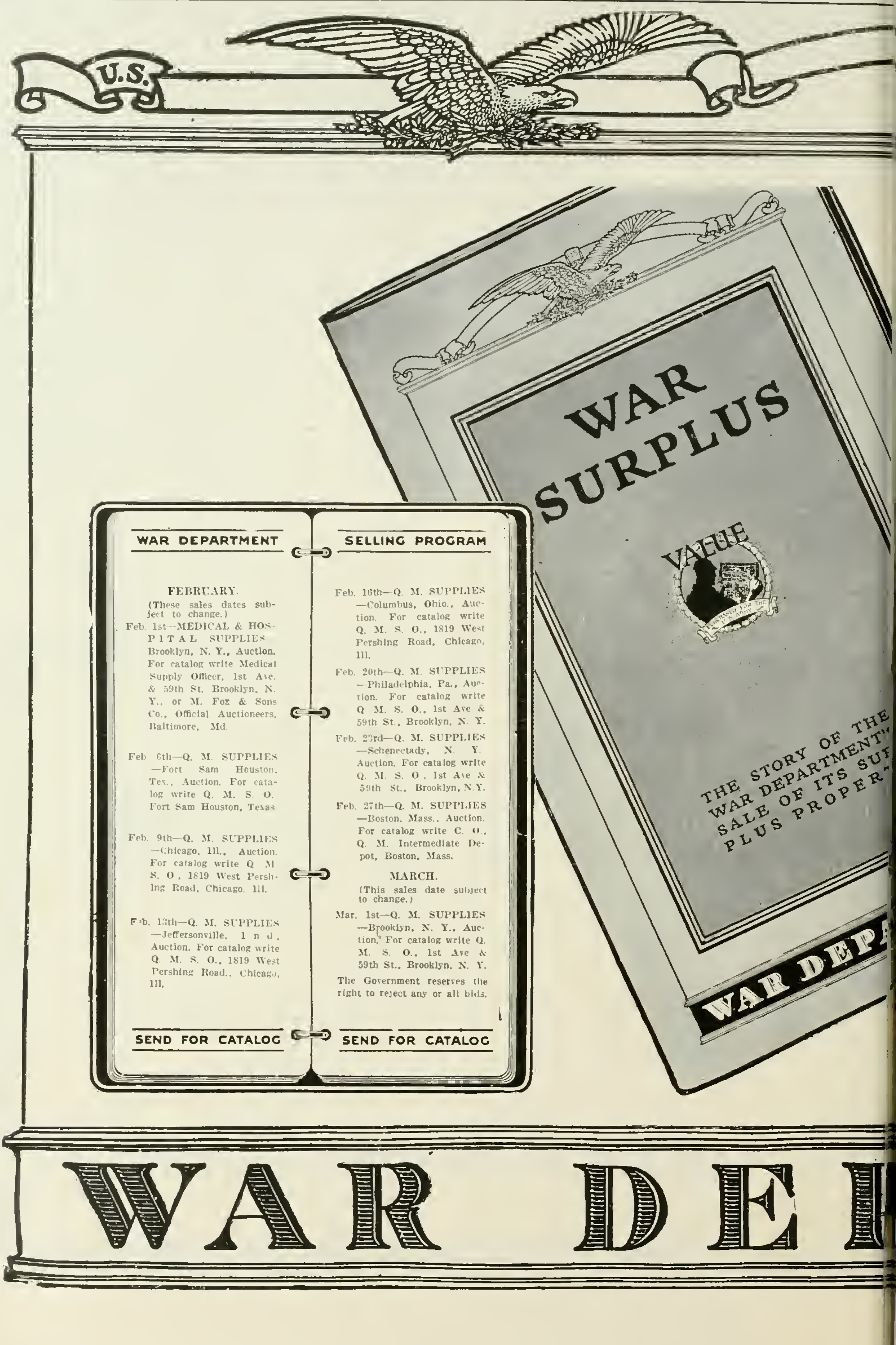
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The Air Mail an Economic Necessity

By Hon. Edward F. Taylor

Representative from Colorado, Member of the House Committee on Appropriations

UPON the subject of our airplane mail service our country has come to a parting of the ways. We must either stop or go forward. The only logical or sensible thing for Congress to do is either to discontinue the appropriation of $1,500,000 for carrying on the present service or appropriate $2.500, 000 to extend and improve it.

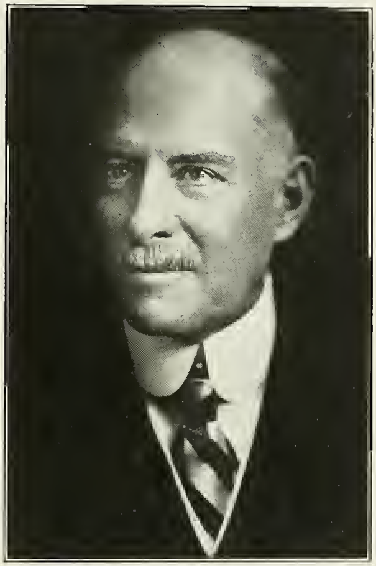
"Without hardly an exception, I think all of the 35 members of the Committee on appropriations of the House are in favor of our going ahead and improving, developing and extending our air mail service by establishing night flying and demonstrating its entire practicability. The Postmaster General and the First and Second Assistants and Mr. Egge, the superintendent of the air mail service, and all the experts say that we have demonstrated fully and conclusively that daylight flying is a success, that daylight carrying of mail is a success, so far as carrying a limited amount of mail across the country is concerned. We do not need to spend any more money to demonstrate that.

"If we are not going to progress any there is no necessity of Congress continuing the present $1,500,000 annual appropriation—it was $1,900, 000 last year—for the continuation of the air mail service that we are now operating every day in the year except Sundays and holidays from New York to San Francisco. But the fact is that just daylight flying does not expedite the mail enough to warrant the expense. We have got to develop night flying before airplane service will ever be of substantial value to the Postal Service or be either a financial or a commercial success.

"There is no place in the world where night flying is in operation at the present time. I believe the forward-looking people of this country hope that our Nation will go ahead and further develop airplane service by demonstrating that night flying is practicable. It is true, of course, that we do expedite a large amount of mail across the country every day.

"Here is the schedule of the 24 airplanes that are in the air every day. The West bound leaves New York City at 7 o'clock in the morning with 500 pounds of letter mail, and travels westward 225 miles to Bellefonte, Pa., by 10 a.m. Another airplane and another pilot leave Bellefonte at 10:15 a.m. and go on to Cleveland, Ohio, 210 miles by 1 p.m. Another pilot and plane leave Cleveland that morning at 9 a.m. and fly to Bryan, Ohio, 160 miles, by 10 a.m. and another plane leaves Bryan at 10:20 a.m. and flies 175 miles to Chicago, by 12:25, and so on from Chicago 195 miles to Iowa City, thence 230 miles to Omaha, thence to North Platte 245 miles, thence to Cheyenne, Wyo., 215 miles, and so on to San Francisco; 2,680 miles."

There is no continuous flight across the country. It is a relay, or rather, a succession of individual flights between certain cities. The outgoing usually leaves before the incoming plane arrives. But, roughly speaking, they do expedite or advance the mail approximately one business day right straight along across the continent. Approximately the same kind of a schedule is being carried out at the same time beginning at San Francisco and going east.



Hon. Edward F. Taylor

Each pilot makes only one of those flights a day, and then flies back over the same route next day with the same plane. He then rests one day and makes the same round trip the next two days.

That route is practically a straight line of 2,680 miles from New York to San Francisco. Adding up the relay flying time—that is the present schedule of the transcontinental trip—is 27½ hours. So we are perfectly safe in estimating that the day and night trip can be made in 28 to 30 hours. It probably will be made within 24 hours within the next five years.

There is no way at this time in which there can or will be developed a paying mail utility except by Uncle Sam. It is not at this time a paying proposition at all for any private enterprise to carry mail. But if we go ahead and they use the appropriation of $1,000,000 or $1,500,000 more, they promise absolutely to demonstrate within the next two years that night flying is entirely practicable. It is now proposed to establish a day and night route across the United States, starting from New York at any time up to noon, and flying to Chicago, and then a night route from Chicago to Cheyenne, Wyo., a distance of about 900 miles. The mail authorities want to make about 30 emergency landing stations on that route. The reason they select that central distance for the night route is, in the first place, that it is a straight line over a flat country. They have already got it pretty well marked out. In the second place, they can always start from New York and make Chicago in daylight, and then make this night flight to Cheyenne and the next forenoon, any time up to noon, they can leave Cheyenne and land in San Francisco, and every day make the same kind of a flight from San Francisco to Cheyenne and a night flight to Chicago, and thence to New York. In other words, it will be a flight from 28 to 30 hours across the United States from east to west and west to east every day.

The Post Office officials and airplane experts feel quite confident they can establish and work the route for $800,000 if Congress allows them to use an unexpended balance they now have on hand, but to cover all contingencies they ask Congress for $1,000,000. That will expedite the mail by flying a distance of practically 900 miles. That is the air-line distance between Chicago and Cheyenne, which will be its night section, going both ways. That money will be expended principally in establishing stations.

Of course they must have emergency stations about every 25 or 30 miles and have them brilliantly lighted at night, so that they can be seen for, say, 30 miles, and large enough so that a pilot can safely land on them at any time any night. And then they will have a string of guide lights about 3½ miles apart, so there will be a continuous string of lights, automatic in operation, from Chicago to Cheyenne to guide them no matter how dark or foggy or stormy the weather may be.

For each of these emergency landing stations, it is contemplated to lease a field or a large square block of ground, at least an eighth of a mile wide and a quarter of a mile or more long, and surround each of them by brilliant beacon lights that can be readily seen for a distance of 30 miles or more and with ample space for the pilot to light safely in any kind of weather.

Those lights are about 70 feet above the ground and of a very intense white light; possibly some of them may be the so-called mercury vapor light. The lights will be automatic in operation. There will be 31 of these emergency fields between Chicago and Cheyenne. Those fields can be leased of farmers and equipped for approximately $15,000 each, and they will, of course, have the necessary local caretaker, and will only be used by the Aviator in case of emergency. Probably 25 out of the 31 will never be used.

The unexpended balance of 1923 will cut down this appropriation, so that, personally I do not believe there will be over $800,000 required to establish all these 25 or 30 stations, which will be permanent and to also erect this string of guide lights, some of them different colored lights, distinctive lights, but mostly white. There will also have to be some signals or instrument that will show the pilot how close he is to the ground at night. Also signals showing the directions and velocity of the wind, and probably some other night signals, especially for dark and stormy nights.

Now, if Congress will make this appropriation and establish that night route from Chicago to Cheyenne and develop a perfectly practical mail route of 28 hours between New York and San Francisco, each way, we believe it can be made a self-supporting proposition and that it will be taken up by other cities and throughout the country generally and that it will soon become a paying commercial enterprise. We hope and believe that airplane carrying of mail will before long be taken over by private concerns and that the Government will be able to let contracts for the carrying of mail by airplane on all practical routes throughout the country and to retire from the business after it has demonstrated that it is a complete success.

This last year, the Post Office Airplanes flew practically 2,000,000 miles without an accident, with a percentage of efficiency of 94.46 per cent. For 10 consecutive weeks this last summer its operation was 100 per cent perfect. Each trip across the continent was started regardless of weather conditions and finished on schedule time. It is universally acknowledged to be the best air-mail service in the world. About 12,000 pounds, or 480,000 letters are each day advanced practically one business day. Of course, between cities that are only 500 miles or less apart night air-mail service is not necessary or practical, because a night train will take all the mail there is put in the post offices up to 8 p.m. which is all of it, practically, and will deliver it in time to be distributed and delivered before office hours or in ample time for business the next morning.

This one transcontinental air-mail route is now carrying 2,380,000 pounds of letter mail each year at a cost of $2.50 per ton per mile.

There is only one man on each airplane. There are 40 aviators in this service now, and 24 of them are making a flight every day regardless of weather conditions, except Sundays and holidays. They are scheduled to fly 1,800,000 miles a year. There are supposed to be 75 planes in active commission. That is two planes in perfect order on the ground for each one in the air. At present there are 66 good planes in operation and about 30 being put in order.

The Post Office Department is doing very commendable and economical work in remodeling Army planes at a very reasonable cost. They are not the best kind of planes for this work, because there is not room in the fuselage or body of the airplane to carry more than about 600 or 700 pounds of mail. The Army planes are designed to carry bombs underneath. But the mail has got to be put inside the fuselage. Sooner or later there will be a different type of plane developed for the use of the Post Office Department that will carry several thousand pounds of mail and merchandise and some passengers. But at the present time, the Army has an unlimited number of Liberty motors on hand and the air mail service is using the Haviland Army planes that the Government now owns.

No human mind can grasp the future possibilities of the airplane. Our country cannot afford to lag behind any other nation in the world in this great enterprise with such marvelous possibilities. A strong merchant air fleet is as necessary to the national defense of the future as a strong navy or merchant marine. The status of commercial aviation in this country has a direct bearing on national defense.

Commercial aviation properly developed will form a reserve power back of the military and naval aviation forces. And our forward-looking citizens throughout the country are not only urging legislation toward developing the airplane service but also toward stabilizing commercial aviation. I see by a newspaper account of a report made by the Aeronautical Chamber of Commerce that the past year has been characterized by remarkable progress in design, construction, and operation. The report says:

> "Nowhere else has there been such startling improvements. American pilots in American machines, powered with American motors, have obtained such results as to warrant the assertion that there has been the most significant series of achievements in the world's history of flight."

I notice also that public-spirited business organizations are urging that Congress encourage improvements in a great many ways toward the further and more rapid development of airplane service. And they point with pride to the fact that the world's records have recently been made by American Aviators. They point to the fact that Lieut. John A. MacReady made the record altitude flight of 40,800 feet, and that he and Lieut. Oakley G. Kelly made the endurance record of 35 hours 18 minutes and 30 seconds in the air; and that those two men also made the long-distance record flight of 2,060 miles, while Lieut. R. L. Maughan made the speed record of 226 miles an hour. And, notwithstanding these superb records, of which we are all supremely proud, our Government is appropriating only about one-third of what either England or France are appropriating toward the development of aviation.

This is not a matter of dollars and cents. I am not appealing on that ground. Our committee appeals on the ground of patriotic national pride. We ask this small, but absolutely necessary appropriation in order that our Government may go ahead and demonstrate to the world that we can establish a thoroughly practical night-flying mail service, and to be the first nation in the world that does so. We ask this to encourage the hundreds of splendid young men who are striving every day to make this great service a great success.

Present Day Aeronautical Problems

By Ralph W. Cram

Editor Davenport Iowa Democrat, Vice President and Governor National Aeronautic Association of U. S. A.

NOT so long ago, a friend of mine said to me. "When are we going to fly around in airplanes just as we ride around in automobiles today?" My answer to him, because of our age, was "*We* never will. But, without question within a short time we will go to Chicago or New Orleans or Salt Lake or San Francisco, also to Paris and London and Petrograd, not by train or steamship, but by airship."

And that is my earnest belief in the matter. I do not think that the time is yet at hand when the average person will own an airplane, but I am quite sure that an airplane or an airship, as the dirigibles are known in the parlance of the trade, will soon be available to all of us for long journeys, the craft carrying relatively large numbers of passengers, operated by transportation companies, financed in a manner similar to the way our railroads are today.

I proceeded to tell my friend that it was a dead loss of one whole day, to say nothing of physical discomfort, for him to go from New York to Chicago by railroad train. I pointed out to him the advantages both financially and physically which would accrue to him if he were able to get in the state-room of a large airship around 9:00 o'clock in the evening, and after a cool and noiseless journey, arrive in Chicago about daybreak the next morning.

Ralph W. Cram

"It all sounds very well", said he, "but I must go by railroad as things stand today, and what I and millions of other persons in the United States are interested in knowing, is what can I do personally, as an individual, to hasten the day of that cool, comfortable, noiseless and speedy journey you talk about?"

I think his query is not only sensible, but typical. There are millions of people in this country today who want to know what they individually can do to hasten the development of aeronautics. During the war, some 25,000 of our young men were in the Army or Navy flying corps. They learned the great advantage of flying, its great saving of time, and they communicated these facts to scores

Germany is the real home of the airship up-to-date. Allied restrictions make it such a home no longer. Germany is trying to do business in airship building in this country. This photograph shows the latest Zeppelin type of rigid airship now in Italy, having been confiscated by the Allies to replace rigids destroyed by the Germans after the end of hostilities. The Bodensee was built in 1919 for commercial passenger and freight traffic and she carried thousands of men, women, and children on schedule trips without mishap of any kind. *Photograph by courtesy of Harry Vessering American Agent of the Zeppelin Company.*

of their relatives and friends. I think it is safe to assume that these 25,000 young men were real "press agents" of the flying game, that at least 25,-000,000 people of this country are today fairly conversant with its advantages. There is only one trouble with the ex-army or ex-navy flyer, as a "press agent". He was taught the art from the viewpoint of a fighting man. To him, although it might be the quintessence of sport, it nevertheless was strongly flavored with the spice of danger. And, naturally, that impression has stuck.

Therefore, I think we can safely say that the most necessary thing to be accomplished before flying becomes popular is to have fixed in the public mind the fact that it is both safe and dependable. Before flying can be made safe and dependable there are a number of things to be done, all of them surprisingly simple when the magnitude of what may develop therefrom is taken into consideration.

It was a comparatively easy thing to hew the Braddock trail and, taking into consideration the fact that it opened up a new physical continent, would seem to make the loss of life and the attendant efforts to shove through over the mountains into the fertile valleys of what is now our Middle West a comparatively trivial affair.

The first trip of Clinton's locomotive was not very difficult of accomplishment and the laying of the first rails and the grading of the first roadbeds were in themselves trivial efforts. The physical work in laying the Atlantic Cable and binding the two hemispheres by quick communication was in itself a small amount of labor when the project is considered in its largest sense. Therefore, it will be seen that it was the public *will* to do these things (in most cases guided by the minds and energies of a few farsighted people) that counted most. So when the public comes to a general realization of the real meaning of air transportation, when the average man and woman gets a great practical picture of it in mind, the things that I am about to enumerate as standing in the way of aeronautical progress will be easy of accomplishment as any of the efforts incidental to the great feats I have mentioned which meant so much for communication and transportation, two of the great needs of civilization.

Briefly stated, the principal problems now confronting aviation are:— First: The establishment of flying routes throughout the United States, equipped with, Second: Flying fields, Third: Signaling and communication systems, Fourth: Adequate meteorological service (weather forecasts), Fifth: Facilities for training flyers, Sixth: Encouragement of the design and development of new design and technique suitable for commercial purposes, Seventh: The development of a body of Federal law regulating the construction and use of aircraft. Also the establishment of an international code for the government of air flight. Eighth: Reasonable but effective standards for insurance, and the writing of aircraft insurance by all suitable insurance companies, Ninth: Encouragement of private enterprise to undertake aerial transportation.

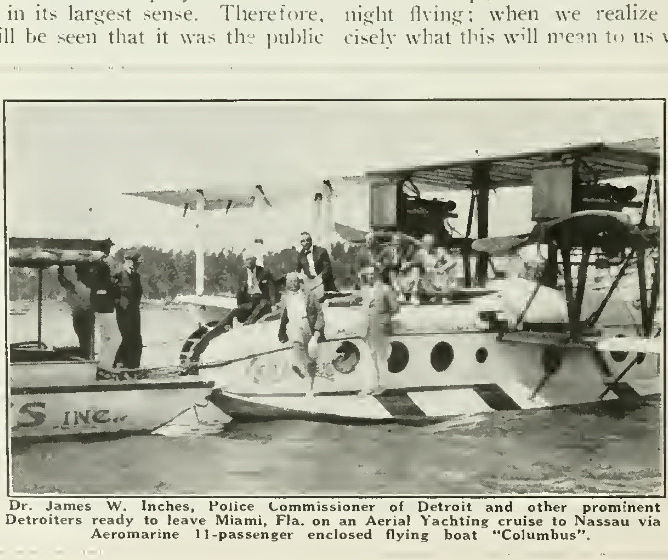
When one takes into consideration the fact that a letter may travel even today between San Francisco and New York in 33-1/3 hours, the actual time in which a plane recently made the trip; and in 30 hours with night flying; when we realize precisely what this will mean to us when we will be able to travel the same distance in an even shorter time and in greater comfort than upon present day trains; when we realize what it will mean to the nation's defense and the nation's business when the entire country is joined together by a network of flying routes so laid out that they will serve strategic purposes in time of national emergency and commercial requirements at all times; when we realize what it will mean to world affairs when all countries will be linked together within a few hours of each other, surely the solution of problems enumerated above should not be delayed or trifled with any longer.

I mentioned as the first thing to be done the establishment of flying routes throughout the country. This work is already underway by the Army Air Service which is working on a model airway between Washington, headquarters of the Army Air Service, and Dayton, the seat of its principal experimental station. It is the purpose of the Army to establish similar model airways in every department of the Army within the limits of continental United States. The importance of this decision cannot be overestimated because these model airways will do much to prove to the public mind that aircraft are safe, dependable and very useful.

These airways will possess landing fields located at convenient distances apart and properly marked and equipped. They will be supplied with the necessary radio communication and I am told the War Department is arranging with the Weather Bureau to furnish meteorological reports covering this particular section for the daily information of those who intend to fly over it.

Even without these added and necessary adjuncts of proper flight, a total of 122,163 passengers flew 3,-136,550 miles in commercial airplanes in the last twelve months without loss of life, according to figures compiled by the Aeronautical Chamber of Commerce. These figures are based on the known performance of 245 planes and it is believed that the number of passengers and mileage would be doubled if figures on the 1000 commercial planes now operating in this country were obtainable.

On practically all inter-city flights baggage and freight were carried, the quantity limited only by the capacity of the craft. None were killed in connection with this air transportation feat. However, I must say that these flights were made where there were elements of risk which should not exist and will not exist when there



Dr. James W. Inches, Police Commissioner of Detroit and other prominent Detroiters ready to leave Miami, Fla. on an Aerial Yachting cruise to Nassau via Aeromarine 11-passenger enclosed flying boat "Columbus".

© U. S. Army Air Service

Aerial view of the State House and Common, Boston, Mass. This city is now building an airport for airplanes and seaplanes, a progressive step which all cities and towns of this country should take in order that they may be linked up in the network of airlines soon to be an established fact in the country

are landing fields at proper distances apart, properly marked and equipped and supplied with radio communication systems and meteorological service.

Thus it will be seen that the Washington-Dayton Model Air Way, and the others which will follow it, will be a long step toward showing the public that problems One, Two, Three and Four can be solved.

The model airways will also be used as the beginning of a solution of problem Six, namely, that of training, for all the reserve officers in the Army Air Service will receive their training in actual flights over these airways.

The remaining problems are very largely dependent for solution upon the manner in which the public is impressed with the results obtained in the attempted solution of the first five. What I mean to say is this; that the vast majority of accidents to aircraft are caused by a lack of landing facilities and an improper knowledge of weather conditions. In other words, when there is an engine failure or something else goes wrong, if the pilot has within reach a fairly good sized place to land the matter is of no more moment or importance than when one's automobile breaks down. If he can be informed that he is running into a storm by means of radio, or if he runs into a fog, if he can steer by means of radio direction finder, if the fields are properly marked for day travel, and properly lighted at night, then flying will become safe and dependable.

Business men of the country should watch these model airways with the greatest personal concern because those of us in the aeronautical industry are firm in the belief that if they are managed properly they can do a great deal toward giving the American public *the will* to solve the problems of jurisprudence and therefore of liability and insurance.

However, the question of jurisprudence is a vital one as far as the inauguration and operation of aeronautical transportation companies are concerned. Those who expect to put capital into air lines must know exactly where they stand in regard to personal and property liability and opportunities for insurance before they will venture their money. Just as soon as the passage of adequate laws by the Congress takes effect, capital will be ready for investment in an enterprise that we believe will revolutionize the long-distance express and passenger transportation business.

There is a great deal more to the question of the jurisprudence of the air than one might suppose on first thought. As the matter now stands, not even the fundamental principles have actually been determined upon. There is even a question as to whether the laws of air flight should be based upon the principles of English common law, or of admiralty law. That is, whether individuals holding title to the land have title to or jurisprudence over the air above the land, particularly at such a height as in no way to interfere with their possession on the surface of the earth.

As soon as properly equipped flying fields are provided and the jurisprudence of air flight becomes established, commercial lines will be financed and started as I have said before. But these concerns in the beginning must be properly encouraged. This encouragement might well be in the form of payment for the carrying of mail and expressage and of guarantees as to the volume of such business. Compensation might be paid to such enterprises for keeping their facilities available for use in time of war. Guarantees of this kind, coupled with the opportunity to insure against loss by accident will undoubtedly go far toward making such privately operated transportation lines paying investments.

I do not mean to say that in the near future airplanes will not be owned to some extent by private concerns and by individuals for pleasure and sporting purposes. Already cattle men are using planes to locate straying herds and oil men are flying between distant wells. In the West air patrols are used for the detection of forest fires, and here, there, and everywhere, planes are used for stunts and advertising purposes, but what I have meant to convey here is that the real commercial development that is almost at hand will be undertaken and carried on by transportation companies organized to handle such business in a relatively large way.

I am told that railroads cost today approximately $125,000 a mile, including terminals and trackage, while the cost of an air route, based upon the experiment of the London to Paris and Paris to Brussels Routes, and those conducted in this country by the United States Post Office Department, does not exceed $5,000 a mile, including terminals and equipment. The obvious question here is what is the relative carrying capacity, as well as the relative speed of transport, safety, and comfort.

Figures compiled by the United States Interstate Commerce Commission show that of the total revenue of a railroad, 4 per cent comes from the express carried, and about 15 per cent from the passengers carried, or approximately 20 per cent of the total revenue of a railroad is from these two sources. Within the relatively near future, there is no reason why commercial aircraft lines cannot operate effectively on a comparative basis with this 20 per cent of the railroad business; and, taking into consideration the relative speed of transportation, there is no fundamental reason why such aircraft transportation cannot be provided at a cost that will be attractive for long-distance transportation.

It is trite to say that speed of installation and speed of operation are in favor of the airplane, and for the quick transportation of passengers and express where the factor of speed is taken into consideration, the airplane has advantages over all other forms of transportation.

To revert to my friend, I sketched the situation to him very much in the way I have given it here. He admitted that it was perhaps one of the most interesting problems in existence today, "But", he said, "What can I do about it?"

I knew that he was a member of one of the leading business organizations in this country, and my answer to him was that he could think and talk aeronautics in his organization and at a propitious time, he could father an aeronautical committee, the purpose of which would be to study aeronautics and to furnish a guide for his particular organization when the time came for it to lend its weight to aeronautical development. At first he was inclined to believe that such a committee would not be active and I pointed out to him that in the membership of his organization were no less than one hundred former officers of the Army and Navy Air Services. "You won't have to force these men to take an interest in this matter," I told him.

I think any organization of business men can with profit to itself organize such a committee. Former Air Service Officers are usually available and willing to engage in this work—the work of boosting the air as a medium for carrying on trade. Already a large number of commercial and civic organizations have aeronautical committees and they are functioning satisfactorily not only in talking aeronautics but in working out more practical problems.

The next step, I told my friend, would be for him, along with his house committee and his employees to take out membership in the National Aeronautic Association of U. S. A., organized to foster and encourage the nation-wide use of air navigation, and then assist in forming a local bureau of the Association, thus assuring co-operation with members and bureaus all over the country.

Many persons now living, can recall those times of fifty or more years ago when torch light processions were held, followed by mass meetings, for the purpose of urging some railroad to include that particular town upon its route. Nearly all of us have seen what happened to the town that didn't get on the railroad. It would certainly seem the part of wisdom for any city in this country today to have a local bureau of the National Aeronautic Association even if it performed no greater function than that of keeping its ear to the ground (perhaps I am mixing my metaphor in speaking of flying, so I will say, keep its ear to the wind).

So in the case of an individual who wants to know what he can do to aid in aeronautics, tell him the most practical procedure he can take is to join the National Aeronautical Association of U. S. A., and if a local Bureau of the Association does not exist in his town, to do all he can to organize one.

It would be very difficult to list all the ways in which a people gets what it wants when it wants it. It is impossible to prophesy all of the various ways in which public opinion will force the solution of the various problems which I have mentioned, but one of the ways in which all great accomplishments are carried through, whether by an individual, a corporation, or a people, is by organized effort. Once let us have public opinion crystallized on the desirability and need for commercial flying; once let us get this opinion organized, and when you want to leave New York for Chicago, you won't start your journey from a railroad station.

The Next Phase of Automotive Engineering

By Henry Ford

[*The following article by the noted automobile builder appeared in the National Aeronautic Association Number of the U. S. Air Serivce Magazine.*]

THE real champions of the people-at-large are our engineers and inventors. The inventor stands with the greatest benefactors of humanity. His work is permanent and the benefits thereof accrue till the end of time.

Centuries hence, the times in which we live will be remembered as the period when automobiles began to contribute their economic service to mankind, and when men first began to fly.

Today the motor car is the greatest example of how an industry can influence the everyday life of millions. Automotive development has brought to a stage of reliability and economic performance the automobile, the motor-boat, and is now being used in the large ocean-going steamer.

In view, however, of the constant search for a means of annihilating time and space, the most serious attention and consideration are being given to aviation. Here is something new. We are standing on the threshold of a new phase of transportation. There is no doubt of the continued development in the navigation of the "air ocean," and such development will far surpass in rapid service any other means of transportation on land or water.

Aviation does not compete with surface methods of transportation. It is a supplementary agency. It is the conquest of the last element in the chain of man's control of natural forces. Henceforth, time, not distance, is the unit of commercial life.

The new art of flying brings new problems to automotive engineers and inventors. When airplanes reached the speed of approximately four miles a minute at Detroit recently, the layman could be excused for thinking that the ultimate had been reached, but there is still much room for improvement. About all that we have learned so far, is that we can fly; the rest is yet to be learned.

The inventor and engineer have the

(*Concluded on page 75*)

A Twentieth Century Cabin Boy

By W. Wallace Kellett

WHAT would an ocean voyage be without the irrepressible cabin boy? Ever since ships have sailed the seas these young adventurers—mere children and often little more than infants—have been just as necessary a part of the equipment of every vessel as the rudder or the Captain himself.

The heroic deeds of which these boys have been the heroes, the lives they have saved, their coolness and bravery in time of distress have so featured the stories and history of the sea, that the cabin boy of today occupies a proud position on his ship. He has a reputation to sustain and he knows it and futhermore, he has a manner and bearing all his own through which he imparts to his passengers (for he considers them his just as much as the Captain's) a certain confidence and sympathy which no other member of the crew can give.

The little cabin boy, regarding you as you recline in your steamer chair in some carefully chosen corner of the deck where you imagine the rolling and pitching of the ship, is not quite so bad as your last resting place, is the first to perceive that you are not feeling exactly as you were when the ship sailed. Shyly approaching, he will deftly engage you in conversation and from that moment, occupied with your new and interesting friend, this little man of the sea, you are likely to entirely forget that indescribably unpleasant feeling of sea-sickness.

It is the cabin boy who carries all the news of the boat. He knows your fellow-passengers—who they are, what they do, and where they are going. He will tell you the history of the boat, when she will make port, tomorrow's weather, the Captain's latest story. He can readily answer your every question. He seems to have an unlimited store of invaluable information.

The cabin boy is just as important to the crew as to the passengers. They wouldn't put to sea without him. He knows more of the hidden secrets, the inner feelings beneath the brawny breasts of these rough seamen than anyone in the world. He loves to be the butt of their pranks of the sea, he loves to have them tenderly curse him, order him, cajole him for he cannot help but know in his own heart that he is loved by every sailor on the ship.

So you will find on every boat there is one popular favorite of all on board—the cabin boy. And he really rules his small world like a king, but unspoiled, unassuming, unaware. If you ask him his title he will promptly say "Only the cabin boy, sir."

W. Wallace Kellett

His duties? They are easily defined. He does everything he is told to do by the Captain, the ship's officers, the members of the crew and the passengers, and does it cheerfully. Then his fertile brain suggests a thousand things which will bring pleasure or happiness or relief to someone on his ship and he does those things of his own free will.

If the ship goes down at sea he takes his place beside his Captain on the bridge and calmly waits the end. That is the cabin boy.

And so we come to Albert—the hero of this story. Albert is a cabin boy. Although he does not travel on an ocean liner and in fact has probably never even been to sea, his voyages are as wide in range and his experiences as thrilling as those of any of his predecessors who ever sailed the briny deep. For Albert is the proud cabin boy on one of the finest and fastest English Airliners flying from the great airport of London to the great airports of the Capitols of Continental Europe. He may be in London today, Paris, Brussels or Copenhagen tomorrow.

When I "snapped" Albert last June, he was in the course of conducting his passengers from his fast British Airliner to the Customs Bureau at LeBourget, the Paris Airport, after a pleasant two-hour voyage from London. His brisk walk, his business-like air and his natty uniform immediately convince one that this young chap needs no one to tell him the responsibilities of his job or how to fill it. Standing to the right with derby hat is one of his passengers. Directly back of him, his hair blowing in the propeller breeze, comes the pilot, charts and clearance paper under his arm.

Albert is one of the pioneer cabin boys of the air. He made his first flight on an airliner early last Spring when one of the leading English Airlines (thinking of the boys on every ocean liner) decided to try the innovation of the air-express cabin boy. Albert and his comrades who fly daily on these liners have quickly become just as indispensable in the nav-

ALBERT, the first twentieth century cabin boy igation of the air as his co-workers in the navigation and life of the sea.

His duties? Much the same as those of the cabin boy from time immemorial. He obeys the Pilot—whom he worships like a God and as you may know by looking at Albert, his Pilot would rather lose his life than have any injury come to this diminutive boy. He obeys the mechanic, he keeps his passengers well-informed and assured at all times.

Albert knows every river, road, lake and town over which his ship flys. Whether over England or France, Belgium or Holland, he can look down from his cabin and tell you immediately just what is below at the moment. He can predict the weather and knows what the condition of the air for flying should be—if your trip is to be smooth or rough. He can tell the instant the motor misses a beat. He knows wireless, how to receive and send and what the signals mean, as well as the other members of the crew. If you are worried, Albert will assure you, if you are bored, he will amuse you and speed up the passing of long hours in the air. If you are ill, he knows just how to make you comfortable.

The little Albert I saw last June, and he is only typical of his comrades who travel on each of these British Air-expresses, seemed to me to have absorbed all the tradition, the atmosphere and bearing of those thousands of cabin-boys who have in the years gone by, developed an "esprit de corps" and a characteristic type found in few other professions. But he seemed also to be adding almost unconsciously an intangible something to all the romance and adventure of those young boys who have gone out to sea before him with the daring and love of conquest of his race.

I have never seen a keener enthusiast for flying and travel by air than Albert. He is doubtless in the air today, returning to, or outward-bound from London, his home port. By this time he has flown thousands of miles and spent hundreds of hours in the air. He has fought his way through storms and fogs, through high winds and air churned with invisible waves as ferocious as those of the most tempestuous waves of the ocean.

I sometimes wonder what Albert thinks as he wings his way at one hundred miles per hour or more, high above the clouds and earth, all attention to his Captain, the Pilot, and always keeping a careful watch over his passengers. I wonder if he has dreams of the future—of what he will become, where he will go and what he will do, when he is a grown up man, some twenty years from now? Yes, like every boy I am sure he has, and who would dare to tell him that his dreams will not come true—every one of them?

I did not ask Albert about all this, but I hope to meet this cocky little fellow again some day.

Aeronautical Fuel, Lubricating, and Cooling Systems

By John F. Hardecker, Aeronautical Engineer, Naval Aircraft Factory

AERONAUTICAL fuel, lubricating, and cooling systems, or, as they are perhaps better known, gas, oil, and water systems, present a very fruitful field for a study of the various materials used, the practical range of sizes of these materials, methods of construction, and the action of service conditions upon these materials. It is proposed to take up each of these systems, consider the various alternative materials, study the construction in detail, and then arrive at the best practice to be recommended for standard use. By giving the advantages and disadvantages of alternative materials in detail it is planned to afford the designer and manufacturer the opportunity to deviate from the recommended practice when he has some special requirement to meet for which he is willing to sacrifice certain other advantages, since, naturally, no material is "best" under every consideration and condition.

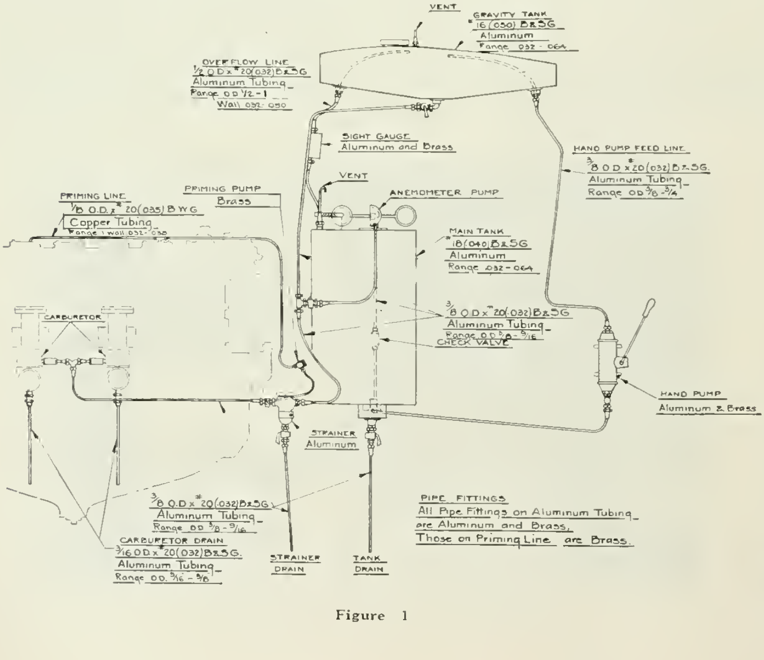


Figure 1

Fuel System

Piping material. The first material that naturally comes to our attention when considering fuel lines is copper. Copper tubing has had the most extensive use for fuel piping in the past. It has the advantages of being easy to work for the mechanic, non-corrosive, and is cheaper in cost than other materials. It has, however, two great disadvantages; namely, its excessive weight compared to aluminum, and the fact that it will corrode internally under the action of gasoline altho it is practically non-corrosive under the action of the atmosphere.

Due to the great weight of copper tubing the next material that suggests itself is aluminum. Aluminum has the advantage of being lighter than any other material suitable for this purpose, and in addition it does not corrode under the action of gasoline. Aluminum has the disadvantages of being somewhat harder to work than copper, and it must also be protected from corrosion in the atmosphere, particularly in salt air.

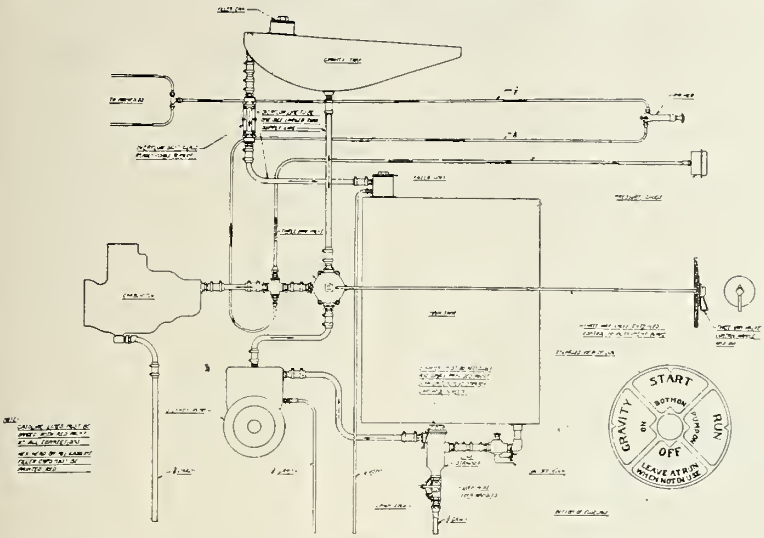


Figure 2

It can be readily protected, however, by coating with spar varnish under ordinary conditions of installation. Aluminum deteriorates slightly more under vibration than do other materials.

Duralumin tubing appears to have the advantages of both copper and aluminum, but it has had no test under service conditions nor is it easily procurable at the present time. In addition, it must be annealed before working and heat treated afterward, or, if heat treated only, the working must be confined to a short period of time after the heat treatment.

Tite flex tubing, which has only recently been developed to the point where it is gasoline tight, is extremely heavy, and its only advantage appears to be flexibility. It may find a special use in those portions of the line which are subject to excessive vibration, such as the connection from a fixed position on the structure to the carburetor on the engine. Generally speaking, this condition can be taken care of by using easy bends and loops in lines of other materials, which will readily permit of expansion and contraction.

Weighing the advantages and disadvantages of the various materials as developed in current practice, the use of aluminum tubing is recommended for standard practice in fuel lines. Its resistance to chemical action from the gasoline is regarded as very important, and the principal objection (its greater deterioration under vibration), may be overcome by using easy bends in the piping which will allow expansion and contraction. Since the primary lines are smaller in diameter than it is practical to obtain in aluminum it is recommended that copper tubing be used for these lines.

Piping sizes. In the main gasoline lines where the flow is less than 30 gallons per hour tubing should be ⅜″ O. D.; between 30 and 60 gallons per hour 1/2″ O. D.; between 60 and 100 gallons per hour 5/8″ O. D; and between 100 and 150 gallons per hour ¾″ O. D. The wall thickness for all aluminum tubing shall be #20 (.032) B&SG. Carburetor and strainer drain lines will vary from 3/16″ O. D. to ⅜″ O. D. The main tank drain will vary from ⅜″ to 9/16″ O. D. depending upon the capacity of the tank. The overflow line from a gravity tank should be one size larger O. D. than the supply or main line, and generally range in size from ½″ to 1″ O. D. The priming line should be ⅛″ O. D. #20 (.035) BWG copper tubing.

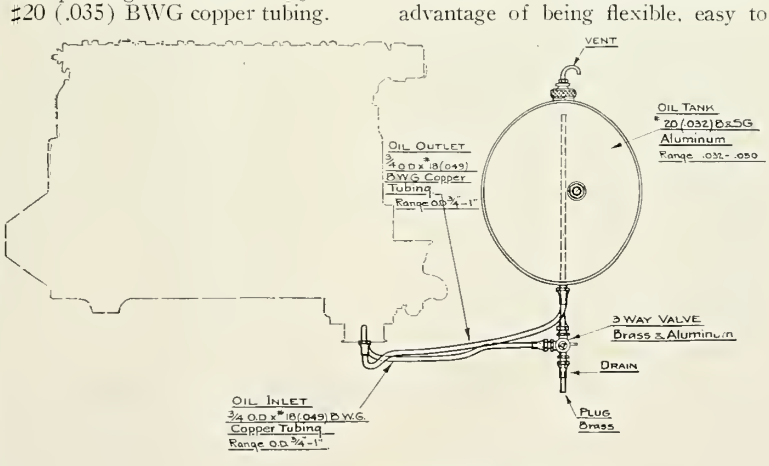
Valves and Fittings. Brass fittings of the soldered union or ring and tail type have been extensively used in the past with copper tubing. Briefly speaking, brass fittings have the same advantages and disadvantages as copper tubing with the added disadvantage that when commercial brass fittings are used, as has been the custom, the excess weight is multiplied since these fittings were originally designed to withstand much higher pressures than any found in aeronautical fuel lines.

Aluminum fittings must of necessity be of the flared union type (SAE standard) since it is not practical to depend upon the soldering of aluminum. They have the same advantages and disadvantages as the aluminum tubing with the additional disadvantage that aluminum to aluminum contact between valve and valve seat and for screw threads is unsatisfactory on account of "freezing."

Aluminum alloy fittings are in general very similar to aluminum. Lynite on Lynite shows up best when tested to determine the effect of gasoline on its bearing properties. Duralumin on duralumin results in the threads freezing under certain conditions. The possibilities of an aluminum alloy being developed that will not involve these difficulties are very good, but for the present none of those developed have really withstood the test of service conditions.

Fibre and bakelite fittings are unsatisfactory for valve and valve seat contact. Where strength is not essential this material can be threaded and may be successfully used for filler caps on tanks and for similar parts.

Rubber hose connections have the advantage of being flexible, easy to



FITTINGS - ALUMINUM & BRASS

Figure 3

make, and inexpensive. Their great disadvantage is the effect caused by gasoline flow thru them. Not only does the rubber hose partly dissolve in the gasoline and thus leave a gummy mass, particles of which are carried away by the gasoline, causing a clogging of strainers and a consequent stoppage of the fuel supply line, but, in addition, the rubber yields sulphur to the gasoline increasing the corrosive effect of the fuel. Aside from the action of gasoline on rubber hose, it deteriorates rapidly.

The Dohner Compression Coupling is a new type of solderless union which has stood up well in laboratory tests. However, it is a combination of brass and steel designed for other than aircraft use and has the objection of weight. It has not yet been subjected to service tests in aircraft.

Until such time as a satisfactory aluminum alloy, which will stand up under service conditions in every respect, is evolved, it is recommended that a combination of aluminum and brass for valves and fittings be regarded as the best practice, using the SAE "flared union" type. The superiority of aluminum may thus be taken advantage of without suffering the freezing of contacting surfaces. By judiciously combining the aluminum and brass parts the amount of brass may be kept low, and its weight and corrosion disadvantages minimized. For priming lines where the fittings are extremely small, commercial brass fittings are recommended. Fibre or bakelite may be used for filler caps, plugs, etc., as previously recommended.

Tanks. Aluminum as a tank material has the advantages of not corroding under the action of gasoline, and of being light in weight. It must be protected against corrosion by the atmosphere especially in salt air. It is easier to damage tanks of aluminum than tanks of other materials in handling. It was formerly very expensive to construct aluminum tanks, but by standardization and simplification of construction the tanks made of aluminum are comparable in cost with those of other materials.

Copper has the advantage of non-corrosion by the atmosphere but the disadvantage of being corroded by gasoline. It is also extremely heavy.

Terne plate, tho relatively low in cost and easy to work, corrodes very readily inside and out. It is also quite heavy.

Duralumin has been used experimentally for tanks but has as yet not been tested under service conditions. It is very hard to work and must be heated after the tank is completed. In thin sheets it tends to distort readily, and the welding and heat treating combine to modify the shape of the tank.

Sheet aluminum ranging in thickness for No. 20 (.032) B&SG to No. 16 (.051) B&SG is recommended for standard use. Enamel baked on to tanks of aluminum furnishes adequate protection from weather conditions, and their natural location in an airplane is generally such as to protect them from possible damage.

A typical gasoline system with an anemometer and hand pump is shown in Fig. 1. The conclusions reached in the discussion of the fuel system are summarized directly on Fig. 1, which not only gives the size of tubing for the particular installation but also the range of sizes (outside diameter and wall thickness) encountered in actual installations. Fig. 2 shows another typical fuel system using a siphon pump.

Lubricating System

Piping. For the oil lines aluminum has only the advantage of low weight while under the same disadvantage discussed under fuel lines. Copper enjoys the same advantages as it does in fuel lines with its disadvantage reduced to the single one of excess weight. Duralumin and Tite flex may be regarded in the same manner as they were in the discussion under fuel systems.

The use of standard copper tubing for oil lines is the recommended practice. The only advantage of aluminum, its lightness, is greatly reduced by the small amount of piping required in an oil system. The outside diameter of the copper tubing is dependent on the size of the oil connections on the engine, while its wall thickness should be #20 (.035) BWG.

Valves and Fittings. The same considerations that led to the recommendation of a combination of aluminum and brass "SAE flared union" type valves and fittings for fuel systems apply to oil systems. Their use is therefore recommended. On experimental work it may be more expedient to use brass valves and fittings which may be purchased commercially.

Tanks. Oil tanks should preferably be made of aluminum. While the superiority of the material is not so great as in the case of fuel tanks still the saving in weight is sufficiently large to recommend its use. The tank capacity should be equal to about 1/10 that of the fuel tanks. All tanks should be provided with a vent tube.

A typical oil system installation is shown in Figure 3.

Cooling System

Piping. Aluminum piping has the advantage of being light, and it is also easier to work than either brass

(Concluded on page 90)

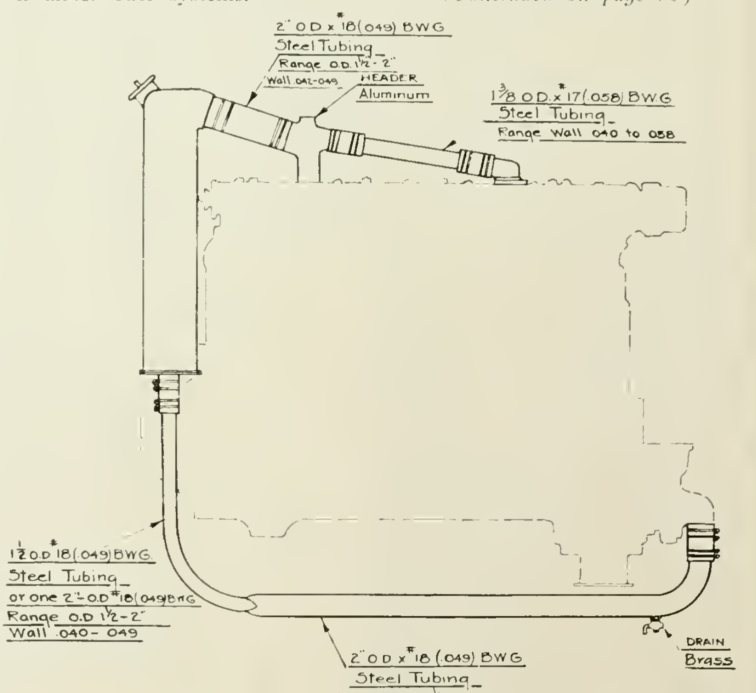


Figure 4

The Rolls-Royce Eagle IX Aero Engine

After a considerable amount of practical experience in the air, followed by much experimenting and testing, a new and greatly improved Rolls-Royce "Eagle" engine has been developed and put into production.

Owing to the many improvements which are incorporated in the design of this latest model it entirely eclipses the "Eagle" VIII which was designed primarily for fighting purposes.

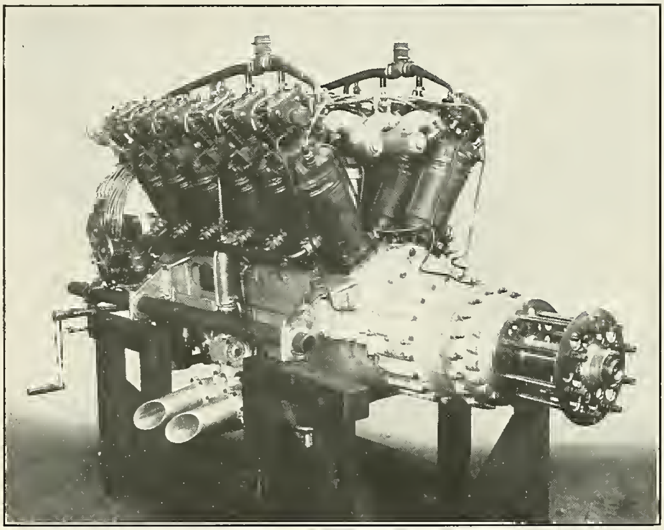
The new model, known as the "Eagle" IX, has been designed to be equally suitable for both peace and war, and amongst others has the following advantages over the out-of-date "Eagle" VIII:—

1. In order to obtain simplicity and other advantages, two carburetters are fitted (in place of four). These carburetters are low down on the centre line of the crankcase. The substitution of two carburetters in place of four considerably facilitates engine tuning and is an improvement, combined with the new induction system, for the mixture to the various cylinders.

2. In order to permit gravity feed to be used in as many cases as possible, the float feeds have been redesigned, and the engine will now function satisfactorily with a head of petrol only 8-inches above the centre line of the crankshaft, which is a great advantage in the design of the complete aeroplane.

3. The danger of fire has been considerably reduced by certain alterations in the design of the carburetters.

4. Other alterations in design have resulted in particularly smooth running of the engine without rough spots, and it is easy to maintain the running of the engine in this condition.

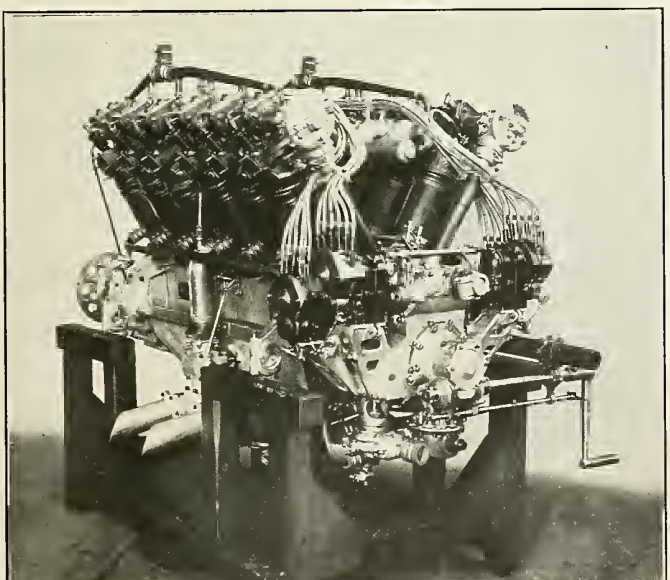


Rolls-Royce Eagle IX

5. The design has been modified in details, in order to provide increased strength or wearing qualities wherever experience has shown that the improvements could be effected.

The photographs forwarded herewith show the completeness of the new engine, and that every detailed requirement for installation has received attention in the design.

In the rear view can be seen the lay shaft, to which all the controls are led, thus making the installation and changing of engines a simple matter.



Rolls-Royce Eagle IX

The hand turning gear can also be seen. The handle is easily changed over to whichever side of the engine is most accessible, and if desired chain wheels may be used to bring the handle shaft down to any position required.

In the photographs the ignition is shown with the magnetos completely screened, and with metallic armoured ignition wires, as supplied when it is desired to use the engine in a machine fitted with wireless gear.

The rubber connections in the petrol feed have been entirely done away with, and the amount of piping reduced to a minimum.

A number of redundant Eagle VIII engines were in the possession of the British Government at the end of the war, and it is believed that these have now nearly all been disposed of, directly or indirectly, to foreign nations, etc. It is expected, therefore, that there will be in future a large demand for the new Eagle IX engines by those who are building new aircraft and require the most efficient and up-to-date engines available.

The International Aeronautical Foundation, (I. A. F.)

By William Knight, M. E.

THE outstanding feature of the great war was undoubtedly the development of the flying machine which made its appearance, at that time, as a new and powerful weapon capable of bringing death and misery into thousands of homes far behind the fighting lines.

Since the end of the war we have further developed the rather crude and primitive instrument of destruction from the air that we had known during the war and we have made of it a deciding factor in both military and naval tactics, an almost perfect instrument possessing all the requirements for destroying in an hour a stupendous amount of lives and property. Furthermore we have transformed the war time flying machine into the peace time commercial aircraft which is probably the only blessing that the war has brought upon mankind.

As the situation stands now, we have a variety of types of military aircraft and each one of them is an almost perfect type of war engine well adapted to the service required of it in time of war. We have also a variety of types of commercial aircraft all representing more or less of a compromise between military and commercial requirements. . . . .with the results that everybody knows.

What Did We Learn from the Last War?

The great war, apparently, has not taught us any lasting moral lesson. We are now as much at the eve of a new conflagration as we were on the fateful days of 1914. Governments of all nations, not excluding our own, are just as blind to the impending signs of the storm which is coming, and shall be just as powerless to avoid its destructive effects as it was the case of a few years ago. Militarism which was blamed for bringing about the war scourge of 1914 is a good deal more powerful to-day in every country than it was ever in the past. What did we fight the last war for? What have we accomplished? What shall we accomplish in the next war? How long will it be before the people of all nations shall refuse to kill each other?

These perplexing questions have been asked by all of us time and again during the last three years and we have reached the point when we have given up the attempt to answer them and we are more or less unresistingly drifting along in the eternal stream of the history of mankind.

I think however that if we are inclined to shrink from answering general questions dealing with somewhat untangible elements, we cannot avoid answering pertinent questions dealing with realities and cold facts.

Next War Shall Be Decided in the Air

A most important reality born out of the war is the airplane. A cold fact, and not a very encouraging one by any means, is that the next war shall be decided in the air, in a very short time, and with such appalling losses which are without precedent in the history of the world, by aircraft dropping bombs, liquid fire and poisonous gases on defenseless cities far behind the battlefields. These are not dreams, these are facts which would become dreadful realities to-day if a new war should suddenly start once more, and we might as well face them.

On the other hand we have the unlimited commercial possibilities offered by the flying machines as a new means of transportation. I think it is safe to predict that the effects of aerial navigation upon the international commerce of the world shall be so far reaching that the flying machine shall become another turning point in the evolution of mankind unequalled by any other previous invention, not even by the invention of the steam engine.

In the meantime, however, commercial aviation is yet at the experimental stage and it will take years and hard work before it will become a profitable business proposition, while instead military and naval aeronautics are to-day the most practical means of offense and defense which have been devised so far.

Commercial Aviation as a Business Proposition

We all know what is going on in civil aviation in the world and, most naturally we measure its success, or its lack of success, in terms of dollars and cents, which is the proper thing to do. The present success or lack of success of civil aviation is contingent on a number of factors: mostly technical, economical and legislative. Commercial aviation needs commercial airplanes, money, laws and regulations. Before, however, money is invested to any large extent in commercial aviation developments, the matter of fair returns for the capital invested receives first consideration. On the other hand, the matter of financial returns from aeronautical investments cannot be separated from the political and legislative aspect of aeronautics (both national and international) and must be considered in its proper order of relation with other existing means of transportation. Commercial aviation cannot be created over night, the same as we created a military aeronautic organization during the war. The problems involved are entirely different and no amount of skillful propaganda boosting aeronautics will succeed in coaxing hard headed business men into aeronautical investments, unless the necessary conditions are first created whereby aerial navigation can become within reasonable limits of time a good field of investment of capital, although aeronautical propaganda is very effective in creating a good deal of public interest in aeronautical activities, and this is very important indeed. If you tell the people that aerial navigation has opened up new fields of peaceful activities whereby happiness and civilization shall be enhanced in this world they will be mildly interested and the public press will be willing to exert enough pressure upon the government to bring about the enactment of proper laws and regulations making it possible to give a start to commercial aeronautical activities. Before, however, we, as individuals give a dollar for aviation, before we entrust our lives and property to aerial transports we want to be shown that it is safe and that it pays dividends. It is quite natural that it should be so, and it is not surprising at all to see that commercial aviation is progressing slowly. Commercial aviation is advancing in a most logical way and, in spite of the fact that it is losing money to-day, there are no limits to its financial possibilties in a few years from now. In the meantime, however, the task of putting it over is left to a limited number of pioneers and far-seeing business men who are willing to discount their losses of to-day because they have faith in to-morrow. It is the same old story of the steam engine and the automobile industry which repeats itself. It is the same old reproof of the fact that, after all, the foundations of any business enterprise are: *ideals* and *faith*.

Aeronautical Preparations for Next War

While this is true of commercial aeronautics, almost the contrary is true of military and naval aeronautics. Aeronautical propaganda which cannot succeed in squeezing a dollar out of the pocket of the public, before it has been fairly conclusively demonstrated that, sooner or later, commercial aviation will pay adequate dividends, when it comes to the point of obtaining money for military or naval aeronautics, we usually start by systematically opposing all requests for increased expenditures in the costly and unproductive business of preparing for future wars.

As individuals, we are more or less mildly interested in this war business (although it is very much our own business to pay taxes for military armaments and to fight when it comes to the point where we have to fight). As a rule, we all are peaceful and we all hate wars, unless we have some old score to settle with neighboring nations. We all hate to pay taxes for military and naval armaments but, if it is proved that we have to do it (and it is always proved sooner or later), if it is proved that we are dropping behind other nations in properly providing for the national defense, why, of course we are willing to give what is needed, because we want to be protected, and as long as there is no other way out, we have to prepare for war the same as the other nations in the world are doing.

This is what has happened in Aeronautics. We have spent during the war and since the war hundreds of millions of dollars for developing aircraft for military uses and we have now some of the best aerial types of fighting machines. The government has not spent a cent for developing commercial aircraft and whatever we have to-day in commercial aviation is due to the initiative of a few individuals.

Scrapping Battleships and Submarines and Building Aircraft

As a matter of fact, when we review what has been accomplished in aviation in this country by individual initiative, with very little money, without government subsidies and, without aeronautical laws, we cannot help comparing the results of individual business initiative with what has been accomplished by military and naval aeronautics, figure out how much we have paid for the latter, and wistfully wonder how much it would have meant to this nation and to the world if we had spent that much money in developing a new means of transportation instead of perfecting a new powerful means of destruction.

A few years ago (or was it centuries ago?) an American had the courage of opposing a set of moral principles (we call them to-day "the fourteen points") to a world in arms. He dreamed of the establishment of a moral super-government which we remember now as a so-called League of Nations and which was supposed to make the world safe for democracy.

A few months ago the American Government startled the world with a bold program of drastic reductions of naval armaments (battleships by the way, have been subsequently proved to be practically obsolete since the development of the aircraft). The submarine was tabooed (which is almost harmless in the presence of an adequate aerial defense) but aircraft, aerial bombs and poisonous gases were left to the various democracies of the world as a means of either enforcing or defending their right of self-determination, or whatever this means.

This Nation Must Be Prepared for Another War

As I said before, we cannot deal with untangible elements such as *right* or *wrong* in any discussion involving the many complicated problems issuing from the war, and hope to solve them with the enunciation of principles. This was tried once by Woodrow Wilson, the most respected man in the world, a few years ago, and, to-day, the most respectable and the most abused man in the world who is blamed for almost anything.

We must have ideals. We must have faith in the inherent goodness of any human being. We must try to develop the spirit of brotherhood in the community in which we live and between all nations and all races of the world. In the meantime, however, we must be practical, we cannot help having nationalistic interests to defend and to fight for. We cannot rely on the moral strength of a League of Nations or on gentlemanly agreements between governments, to protect our shores, our land and our lives. We must prepare for war, and therefore we must have aircraft, aerial bombs, liquid fires and poisonous gases, same as any other nation, until such a time when the human relationship existing between nations shall have the same meaning as that which prevails among the people of any one nation.

Until such time comes we must take the world as it is and the only way we can develop a better sense of international responsibility between governments is by taking our own share of responsibility in the work involved. So far we have been primarily concerned with national policies, and our interest in international political events has been generally limited to that extent to which our own nationalistic interests were concerned. The matter of peace and war, and the conditions which are fatally bound to bring about either peace or war, are always brought about by a few. If errors are made by the representatives of the people in domestic politics we can always correct them. If errors are made in foreign politics, we cannot always correct them and if that means war, all we can do is to fight.

Next War Shall Be Fought Against Women and Children

There seems to be something fundamentally wrong in such a state of affairs which, however, we cannot change over night—changes will take place in time through a slow but steady progress of evolution of government functions which shall, however, always be induced by the evolution of our own individual sense of obligation to our own people and to the people of other nations.

In the meantime, considering the fact that, judging from all indications, the great European War is not going to be, by any means, the last war in the history of mankind, we must prepare ourselves to see another war which, however, will be the most barbarous war ever fought and the most shameful prostitution of American genius which gave the flying machine to the world.

The next war will be fought and decided in the air, and the trend of evolution of present day military aircraft points out the undeniable fact that long distance bombing machines intended to operate at hundreds of miles behind the fighting lines against thickly populated cities, will enforce peace among the men at the front by killing the women and the children of the cities in the rear.

The war game, helas, has lost the charm and the poetry of the days when knighthood was in flower. In this highly developed industrial civilization of ours, war involves the use of powerful engines for the destruction on a large scale of human lives and property

At the beginning of the last war, the airplane almost revived the gallant individual fights of mediæval knights. The aviators of those days were the heroes of the blue sky who fought homeric single handed combats in crudely made flying machines and died like men under the sun and over the battlefield before the eyes of two opposite armies. During the war, however, the use of the airplane changed. No more blue sky and face to face combats for the heroes of the air, but the cover of darkness and the raids over Paris, London, and over dozens of cities in France, England, Belgium and Germany wrote with bombs the first pages of the history of the engineering and military developments of the aircraft.

Since that time other pages have been written and the aircraft of to-day, as I said before, is an almost perfect war engine and we must pray God that we may never fully know how efficient it is.

Should We Disarm in the Air?—No—

Should we take upon ourselves in this country the task of condemning the airplane same as we did condemn the submarine? Should we deny to our Army and Navy the appropriations that they need in order to build and to maintain our air forces up to the strength which is consistent with the safety of the nation under any conceivable emergency which may arise in the future? Should we rely on future agreements between nations, regulating the use of aircraft during the war?

To any and all of the above questions I answer most emphatically: *NO*. We cannot wipe out of our civilization the most efficient means of transportation which has been first created by American intellects and which represents the only objective lesson in internationalism which has been taught to the world by the war, when the commercial aircraft was born. We cannot, without being traitors to our country, refuse millions or even billions of dollars needed for the national defense when other nations between the prospect of bankruptcy and armaments are choosing bankruptcy. Finally we cannot rely on international treaties regulating the use of aircraft in time of war and on gentlemanly agreements between nations to be respected by all nations in time of war. We have seen in the last war how international treaties became scraps of paper, and humanitarian sentiments have no meaning at all in a twentieth century war which is fought with aerial bombs, poisonous gases and deadly bacterias.

Will the citizens of this country and the citizens of the world view with indifference the raising or rather the lowering of the aircraft, from the ranks of a most wonderful potential carrier of the commerce of the world, into the ranks of the most powerful destructive machine far exceeding the power of guns, battleships and submarines? I hope not.

How Can We Protect Ourselves Against Military Aircraft?

What can we do? What force can we oppose to the destructive force of the aircraft in time of war? How can we kill the military aircraft without at the same time killing the commercial aircraft?

There is a force in the world which is stronger than any other force in nature and this force is the spark of the divine within ourselves which manifests itself through any human intellect each time that we perceive the divine relationship existing between all creatures of God. Unfortunately, however, the human race has not progressed yet far enough along the path of spiritual development and we are unable to perceive at all times and in all cases such a relationship.

Human nature, however, is fundamentally good at any time and in any circumstance and is wonderfully responsive to any appeal which is made to this sense of humanity when such an appeal is not motivated by a selfish purpose. The fact that after two thousand years the teachings of Christ are yet the foundation of our present day civilization is a proof of such a contention. The fact that the fourteen points enunciated by Wilson during the war were accepted by the people of all nations is another illustration of this fundamental truth.

Men, however, who in their individual relations with other men are regulated by their own finer nature (more or less modified by education and by the surroundings in which they live), in their collective relations with other groups of men are influenced by the mentality of the particular group to which they belong and which is to a great extent directed by a limited number of men possessing the power for good or for evil to shape public opinion and to create public sentiment—I think that the presidential campaign in this country in 1916, the election of Woodrow Wilson on a platform of "We are too proud to fight" and the subsequent change of a few months later shows the power of leadership over the moulding of public opinion and public sentiment.

The International Aeronautical Foundation (I. A. F.)

Why not make use of these two tremendous forces in order to curb the evil power of military aeronautics: *The inherent goodness of human nature in the individual and the organized power of mass psychology artificially created for an unselfish motive?* It is with this view in mind that the idea of the International Aeronautical Foundation was born.

What is the International Aeronautical Foundation? It is an idea to-day, which shall become a powerful force to-morrow under the able leadership of a small group of women and men animated by the unselfish desire to serve the cause of their country and of humanity. It is the beginning of a movement which carries within itself enough force to stop war forever. It is the blossom of a seed sown by the first citizen of the Confederation of Nations: Woodrow Wilson, the greatest veteran of the late war and the leader of a movement who can be judged only by history.

I shall try to outline briefly the proposed object of the International Aeronautical Foundation (I. A. F.)—The purpose of this projected organization is to enlist in its membership individuals and organizations of all countries in the world who are prepared to endorse the first fundamental principle of the I. A. F.—*FIRST: TO RESPECT, TO UPHOLD AND TO HELP TO ENFORCE ANY INTERNATIONAL LAWS AND REGULATIONS AGREED UPON BY CIVILIZED NATIONS REGARDING THE USE OF AIRCRAFT IN TIME OF WAR, AND IN NO CASE TO USE OR TO CONCUR IN ANY WAY IN THE USE OF AIRCRAFT IN TIME OF WAR FOR THE PURPOSE OF DESTROYING HUMAN LIVES AND PROPERTY BEHIND THE ONE OF OPERATION OF THE ARMIES.*

Any individual and any organization of any country in the world who can take the pledge to live up to the first fundamental principle advocated by the I. A. F. can become a member of the Foundation.

The Second fundamental principle of the foundation, the acceptance of which is optional, is as follows: *Second:—To help furthering the advance of aeronautics and to encourage the use of Commercial aircraft along both national and international lines.*

The Purpose of the I. A. F.

This organization should be non-political, non-sectarian and truly international in spirit and in actions. Its main purposes being:—

1) To create in this country, a popular educational movement leading to the condemnation of the barbarous warfare tactics, inaugurated in the late war, when, through the use of aircraft and poisonous gases, the military operations at the front were extended behind the zone of the armies against civilian populations.

2) To concur to the establishment of local groups in foreign countries for the extension of the work of the I. A. F. in every civilized nation, such as to create an international movement sufficiently strong to force the adoption of international laws and regulations and to bring about in all countries appropriate reduction of aerial armaments which shall sufficiently guarantee that, as long as wars shall have to be fought between civilized countries, time honored respect for the rights of noncombatants and for the sacredness of international treaties shall not be trampled upon again.

3) To create in this country and to concur to the creation in other countries of a sense of international responsibility between scientists and technical men engaged in advancing the progress of aeronautics and sciences thereto allied, in the final use of their inventions. To offset any unfair use of such inventions and to help to disseminate knowledge in aeronautics, in the interest of the commerce of the world, a cordial exchange of information and technical data between scientists and technical men in the world should be established through the I. A. F. and the knowledge thereby acquired should be disseminated among the members of the federation through publications edited by the foundation.

4) To encourage scientific research work in aeronautics and to promote the study of international problems involved in the political and the business aspect of international aerial navigation.

5) To promote a spirit of international co-operation and a sense of class responsibility among members of aeronautical clubs and associations of all countries in the world which are in any way concerned with aeronautical activities.

These are briefly the main objects of the I. A. F.

I have been informed by a number of perfectly honest and well meaning people possessing the gift of a critical mind that my project is not practical because it is very much in advance of our times, but is otherwise a very beautiful and realistic dream which everybody should be glad to see become a reality.

I consider such a comment as a great compliment and I see once more in this comment a proof of the eternal struggle between the spirit and the critical mind, between the natural creature of God and the artificial product of education and surroundings and I bless the Lord for preserving my power to dream, without impairing my facility to deal with realities (which has been my lot during twenty-two years of successful work as an engineer and as a business executive).

A Dream and a Practical Reality

I shall try now to outline briefly how, in my estimation, the beautiful dream could become a practical reality.

Let us assume that an organization committee is formed, composed of a dozen or so of representative men possessing the gift of leadership and who have been fortunate enough to go through life, fighting all its hard battles, without losing confidence in the goodness of human nature (and there are thousands of such men in this country and in every other country in the world).

Let us also assume that enough money is collected among people who are fortunate enough to be able to give, and that a well organized educational and membership campaign is started in this country.

The first move in this campaign, in my estimation, should be to interest the women of this country, through their many organizations and I think that the American Gold Star Mothers organization should have the privilege of being the first member association of the I. A. F.—Women, unlike men, have been endowed by nature with a keen sense of justice which is not obscured by their highly developed mental powers, and is never submerged in the mass psychology which dominates men. Women were intended by nature to bear children who are the nearest to God that we can conceive of, and it was for the grace of the Lord that they received a higher soul than man. Women in this country are one of the most powerful social factors and with their support and their active collaboration, the I. A. F. can and must be organized.

The second move should be to enlist in the membership of the I. A. F. educational institutions. Let all the children, young girls and young men in the country know that their school has endorsed the first fundamental principle of the I. A. F.

After this is done go after the American Legion, the Association of War Veterans, the Red Cross, the Y. M. C. A., the Y. W. C. A., the Churches of all denominations, the Labor Unions, go after every Association, Club, or congregation of men and women in this country which is willing to pledge its allegiance to the first fundamental principle of the I. A. F.

When this is done, start an individual membership campaign and start it from the top—enroll the President of the United States and the members of the Cabinet. Enroll every member of Congress and every member of the Air Service of the Army and Navy.

By the time that this is done in this country a similar movement will be well under way in all other countries in the world and it will only be a matter of skillful organization to create a single powerful international non-political and nonsectarian organization with far reaching possibilities for the future and possessing the two irresistible forces which I have mentioned before:—*THE APPEAL TO THE INHERENT GOODNESS OF HUMAN NATURE AND THE ORGANIZED POWER OF MASS PSYCHOLOGY ARTIFICIALLY CREATED FOR UNSELFISH MOTIVES BY A FEW LEADERS POSSESSING IMAGINATION AND CRITICAL POWERS.*

But let us go still further with the beautiful realistic dream:

Membership Organization of the I.A.F.

The way I consider the practical membership organization of the I. A. F. is as follows:—

Membership in the I. A. F. should be divided into three classes: Honorary members, Active members and Inactive members.

Inactive members should be requested to pledge their allegiance to the first fundamental principle of the foundation and to contribute to its financial support with voluntary donations only. This grade of membership to be open to individuals and organizations not directly engaged in aeronautical work.

Active members in the I. A. F. to be divided into five grades:

1—Fellow member
2—Senior "
3—Associate "
4—Junior "
5—Candidate "

The five grades of membership as mentioned above from number one, which is the highest, to number five, which is the lowest, to be open to individuals actively engaged in aeronautical work graded according to the importance of the work that they are performing.

Grade three, associate membership, to be open to both individuals and organizations engaged in the performance of aeronautical work. All other grades of membership to be open to individuals only.

Honorary Membership to the I. A. F. to be open to individuals and organizations:—

First—who have made exceptionally important contributions to the work of the I. A. F.

Second—who have made exceptionally important contributions to the development of aeronautics and sciences thereto allied.

Third—who have made exceptionally important contributions towards the establishment of better relations between nations and between fellow men in the interest of peace and progress.

This is, briefly, the outline of that beautiful dream which I have called the International Aeronautical Foundation and which could have almost any other title from the most conservative and dignified: "League of Humanity for the sake of Humanity" to the futuristic title: "Aeronautical League of Nations" or the revolutionary title: "International of the Air".

I have tried very hard to convince myself of the unpracticability of realizing this dream, but I must confess that I cannot see it that way.

Where are the ten or twenty leading men and women who will compose the organization committee of the I. A. F?

Where are the champions of a beautiful dream, who have the gift of being able to dream and to act?

Emergency Landings From Low Altitudes

THE large percentage of accidents in the Army Air Service in taking-off caused an investigation which discloses interesting facts and statistics of prime interest to every pilot, operating manager and insurance. An analytical report has been prepared by the Air Service under the above title and *Aerial Age* presents the outstanding features following.

It was found that these accidents were due to the efforts of pilots to turn back into the field when engines failed on the take-off, without sufficient altitude to complete the turn.

For each design of airplane there is a minimum altitude below which a complete 180 degree turn can not be made. Following is a tabulation giving these minimum altitudes. Full military load is considered in each case. If the airplane is flown without full load, the altitude lost will be proportionately less.

The altitude given for each type should be taken as an absolute minimum for a complete turn of 180 degrees, and can only be obtained by following fairly closely the air speeds and angles of bank which are recommended. Both theory and experiment point to the fact that a reasonable deviation from these conditions does not greatly increase the loss in altitude, and, with average piloting, an airplane can be turned back with

(Concluded on page 90)

Model	Total Wt. in lbs.	Minimum Altitude in Feet	Most Efficient Air speed in M. H. P.	Best Angle of Bank	Radius of Turn in Ft.
DH4	4297	340	75	45°	380
SE5	2058	270	70	45°	330
JN4H	2200	230	60	45°	240
MB3	2548	400	78	45°	400
XB1A	3679	300	73	45°	360

Sailing the Air With Wind Power

By D. W. Starrett

(Copyrighted.)

AT the present time there is a concerted effort to sail aeroplanes without power, other than that of the wind. It seems that the impetus for this movement comes from the remarkable results that have been attained by F. H. Hentzen, the young German aviator, sailing his motorless glider, *Vampyr,* over the Rhone valley in Germany, as recorded in the *Literary Digest,* of October 7th, 1922.

Some writers would like to make a mystery of this remarkable feat, as tho he had discovered a new law, and were liable to give it to the German government, which would use it against the Allies. France, especially, is wrought up over the fact that this aviator stayed in the air for three consecutive hours.

France, however, need not be nervous over the results of this flight. Should the principle which will be disclosed in this article reach the German aeroplane builders, the Allies will have cause to be excited, unless they use a little reason relative to the matter.

No doubt aeroplanes can be constructed so that without other than wind power, they will be able to carry great loads, and sail where they desire to go.

The accomplishments in motorless aeroplane flights, recorded in the *Literary Digest,* Oct. 7th 1922, of Orville Wright, in Oct., 1911, and recently those of Mr. Glen Curtis, as well as those of other German aviators beside the one mentioned, have set the flying world agog.

In 1908 the present writer copyrighted the principle about to be disclosed, and it was published in 1910, in the *Philadelphia Inquirer,* and in March, 1912, in the New York *Aircraft.*

He disclosed in those articles the mechanics of motorless aeroplane flights, which might continue as long as the wind blows. The wind blows all of the time somewhere, and it always blows along discovered tracts with as much certainty as it does over the ocean enabling sailing vessels to carry the world's freight.

There are two principles involved that will enable one to accomplish the results attained in Germany in motorless aeroplane flight, and wingless flight by many kinds of birds.

It is known that the frigate bird can stay in the air indefinitely. It steals its food from other birds on the wing, and rises to great heights and sleeps while sailing without wing movement in great circles. The great swooping crane will rise from Lake Winnipeg, and set its wings and sail straight to the Gulf of Mexico, never once during its flight flutter its wings for propulsion purposes.

Man so far has not imitated the birds in this regard.

The present scheme of sailing gliders by wind power is nothing more than taking advantage of the rising currents of air, very much as a piece of paper rises on the up-currents of air and floats for miles. But it is obvious that the use of such currents will never enable the German to do much damage anywhere with motorless machines for the purpose of dropping dynamite upon his enemies. It would have no chance whatever with a motored aeroplane manned by a skilled aviator. And as to that, no machine driven alone by wind power will ever be able to cope with war aeroplanes driven by engine power and manned with guns.

The great principle to be disclosed in this paper means that aeroplanes using it will only be able to carry articles of commerce and passengers cheaply.

In 1910 the writer constructed an apparatus that proved the principle of bird wingless flight.

Two sheets of typewriting paper were pasted together to form a wedge, with the thickness of the sheets for the thin edge of the wedge and braced apart with paper ribs five-eighths of an inch for the thick end. At each corner a fine wire ring was pasted through which wires could be passed. These wires were stretched about four feet above the ground, and the paper wedge was placed, with the wires passing through the rings, so that the thick end faced the wind squarely.

The wedge was placed upon the wires at rest, almost instantly it moved directly into the teeth of a fifteen mile gale. A test was made and it was found that starting from rest it moved against the gale thirty feet in eight minutes.

Inertia was overcome by the wind power. It is true that birds rarely start from rest, but it is because they naturally hop when making a start, for wingless flight.

Birds always face the wind when sitting in a gale, for otherwise they would be blown over, the wedging of the body and wings causing the wind pressure to balance them closely. For instance, if they light upon a flag staff they face the wind or the direction in which the steamer is sailing, depending upon which is the stronger.

From this it may be realized that a motorless aeroplane properly constructed as regards the wedging angles of wings and body, and due regard paid to a frictionless surface, such as feathers present to the wind, can carry freight and passengers in any direction, with a power equal to that of the wind. With very little momentum one could start from rest, as the model proved.

The principle used by the gliders will never be able to carry much load, because they do not utilize very much of the wind power.

The principle here disclosed is far different from that utilized in the gliders. The wind strikes the blunt end of the wedge and it is compressed against the air above and below it, which acts as a storage power, like a spring, so that as soon as it gets by the thick end of the wedge it rebounds against the angles of the wedge, and squeezes it forward. With the bird this occurs both on the wings and body.

Such a machine can even do what ships accomplish upon the ocean, tack at almost any angle from the direction of flow of the wind, up to about thirty degrees.

To sail with the wind in such a machine one will have to volplane for a certain distance, then circle into the wind to gain lost height, and then repeat the operation indefinitely. This is why birds circle when making wingless flight with the wind.

The reason why aeroplanes have not made such flights, is because the wings have not been given sufficient wedging power, and their surfaces and that of the body have not been given proper frictionless surfaces.

The Soaring Wave

By J. Ed. Sheriff

I HAVE been interested in soaring flight for some thirty years, and was delighted by your splendid report of the European success in this line.

There is a very important factor in the accomplishment of true soaring that is very generally ignored, namely, the soaring-wave.

I discovered the soaring-wave in the summer of 1913 by the use of smoke streamers placed to windward of an aerofoil.

It is in all probability the soaring-wave that makes it possible for the albatross, turkeybuzzard and hawk to soar over great plains and the sea; and to do so on cold,

The Soaring Wave

cloudy, windy days when there is no logical excuse for even suspecting rising currents.

The soaring-wave is apparently generated on the wing and later extends to windward in gradually decreasing waves. See accompanying drawing.

When a hawk does a soaring hover he always drifts for about one-half second while the soaring-wave is extending to windward.

In a yacht race to windward, all else being equal, the boat with maximum working leach in mainsail will win; because it will generate a greater soaring-wave.

The non-technical theory of soaring flight based on the soaring-wave, and without ascending currents, is quite simple. There must be a wind. A wind is a horizontal movement of gaseous fluid mass, relative to the bird and the Earth. Gravity as an invisible kite-string connects bird and Earth. With the entering edges directed to windward the air can pass the aerofoils (wings) in the shape of a wave or sinuous current only; which, following the laws of fluids in motion, extends a considerable distance to windward. Now, as the length of the sinuous path is greater than the straight course of the wind, this sinuous stream (the soaring-wave) will be accelerated by the surrounding air in motion, i. e. it will be acted upon just as though it were a liquid wave. Thus the wind will be slowed, in giving up energy to the wave.

Due to the shape of the wing and its position relative to the wind, the wave cannot strike it on the upperside, but can strike the underside, thus thrusting forward and upward.

With a strong, steady wind or gale, blowing over a great plane on the sea, a true soaring bird can travel rapidly against it, without employing circling flight, or rising currents. Circling flight is resorted to in light breezes, as it is another means of extracting additional energy from the relatively moving air.

In the midst of a great plain, on a cold cloudy day, with the ground cold and a steady gale blowing roofs off barns; I have seen a turkeybuzzard rise vertically from a carcass and soar out of sight to windward without circling; having gained altitude of some 2000 feet.

The Fokker Amphibian

DURING the Fall of 1922, the Fokker factory at Amsterdam has produced a new type of Amphibian flying boat, which shows many interesting features and is characterized by excellent flying qualities, a characteristic for which flying boats have up to the present not been particularly noted.

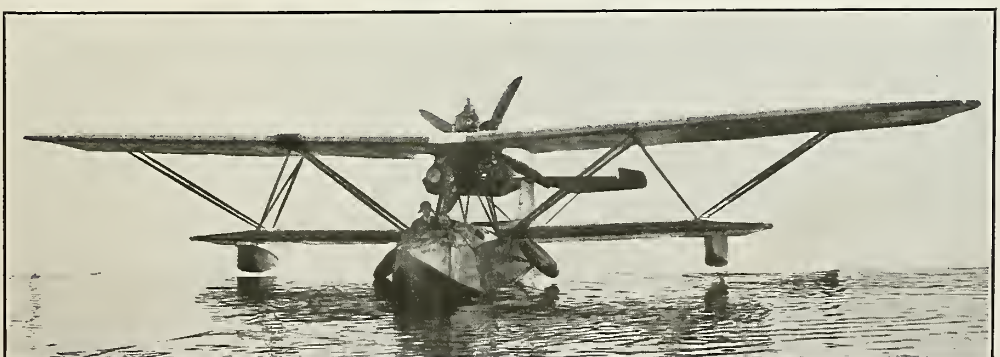
Primarily designed for Naval Observation purposes, especially in the Dutch Colonies, the Fokker Amphibian is however adaptable to many commercial purposes, a number of the constructional features making especially for economical operation.

The *boat* is entirely constructed of duralumin and has proved to have very favorable lines for a quick get-away. The type of construction used is very simple and much more easily repaired than is usually the case with metal constructions. Great strength fore and aft is obtained throughout the boat by continuing the keel upwards in the form of a central girder up to the deck of the boat. There are eleven watertight compartments, which are formed partly by the central girder and partly by the bulkheads. The closed sections are accessible through manholes. The bottom of the boat has two open steps.

The *Seating Arrangements* in the Naval type are as follows: In the bow is the observer's cockpit with emergency controls. The seat and the controls can be folded away when not in use, when it is desired to use the gun ring. Through a passage on the starboard side of the boat, access is obtained to the mechanic's cockpit, which is to the right of the pilot. The pilot's complete *controls* with the seat, are mounted on a detachable frame forming one unit. The mechanic's seat can be folded up and it is then possible to pass through to the next compartment, which provides complete accessibility at all times to the *collapsible undercarriage*.

The shock absorbers and entire lowering and raising mechanism can in this way be reached even during flight and adjusted if necessary.

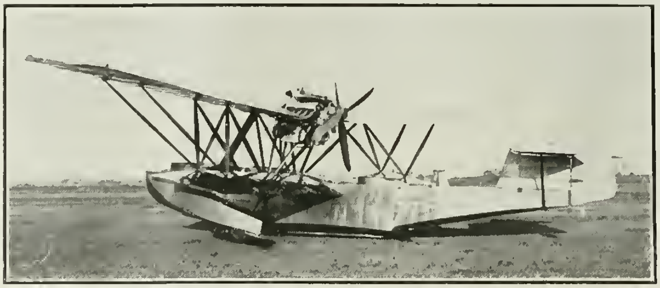
The *undercarriage* is very simple and consists of short axles and radius



The Fokker Amphibian on Water

rods hinged to the boat, with compression struts which run diagonally upwards from the wheels into the boat. These latter telescope for raising and lowering the wheels. The raising crank can be actuated by the Pilot, or by the mechanic, or even by the observer in the bow. The lowering of the wheels is instantaneous and automatic, but the pilot has also a pedal with which the locking wedges can be further positively locked after the wheels have been lowered.

The *Gasoline Tanks*, which are in the next compartment aft of the landing gear, have a capacity of 120 gallons.

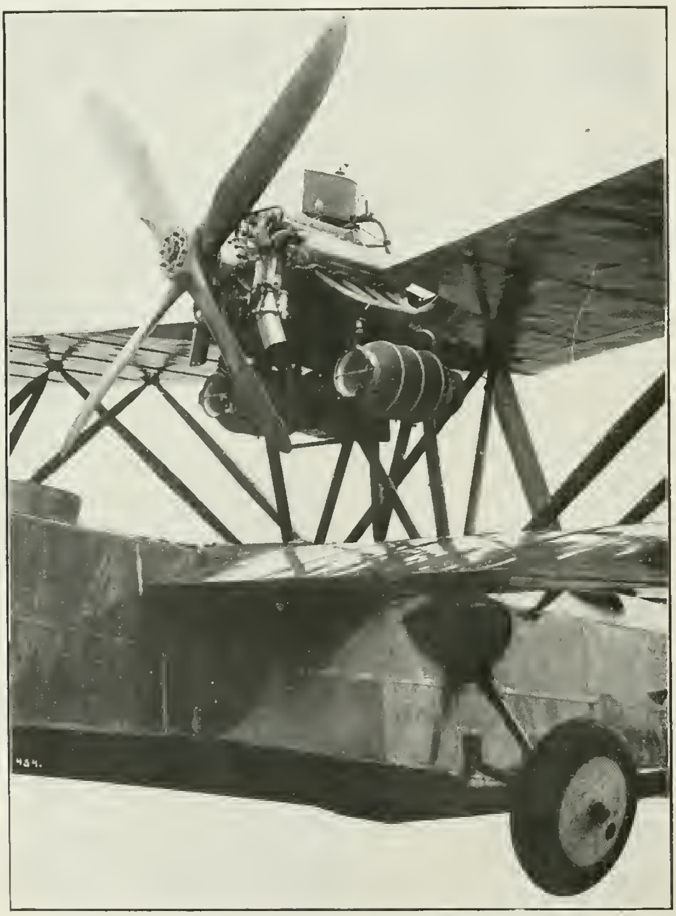


The Fokker Amphibian on Land

Further aft is a *second observer's cockpit*, which brings the normal number of crew up to four.

An extremely strong, steerable, combined *tail skid* and *water rudder* is attached to the rear step.

The good flying qualities of the Fokker Amphibian are particularly due to the special arrangement of the wing panels. The upper plane, built in two parts entirely from wood and veneer covered, is considerably swept back and attached to a steel tube strut pyramid on the boat. The bottom plane, which is in one piece and also constructed entirely of wood, lies in a considerably staggered position with respect to the top plane, and directly on the boat; it is not back swept but has a slight dihedral. The wing bracing is by struts only, in the form of a modified Warren girder. The wing tip pontoons are made from duralumin and suspended or shock absorbers. If for special purposes, the wings can be also constructed entirely of metal.



Power Plant Installation on the Fokker Amphibian

The *tail unit* is very simple in construction, it consists of a thick cantilever fin with rudder and a tail plane with elevator. The tail plane incidence is adjustable from the pilot's seat, the adjusting mechanism being carried inside the fin. The entire construction of the tail surfaces is in a steel tube, fabric covered.

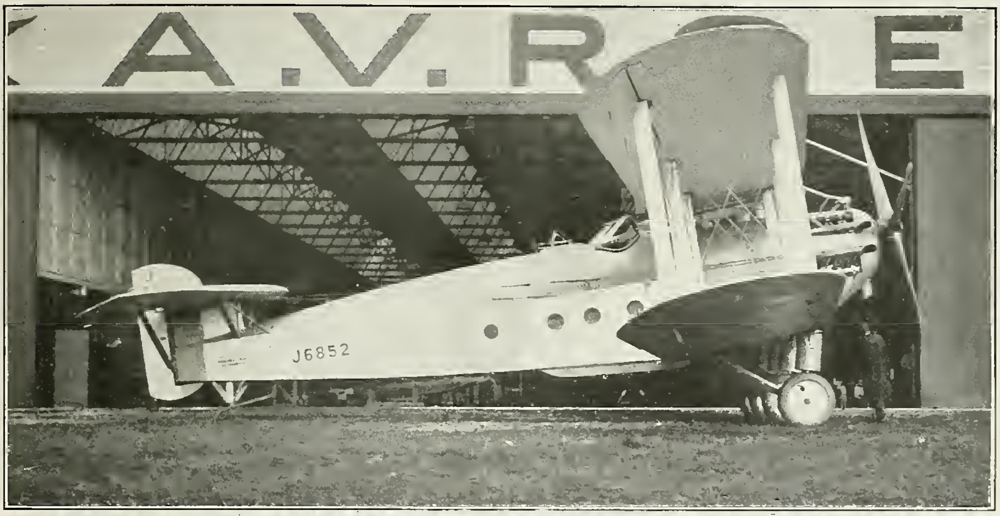
The *engine* is mounted with the radiators and the oil tank as a unit, as in the latest Fokker Commercial planes. This unit, consisting of engine, radiators, water connections and tank, oil tank and oil connections and exhaust stacks is connected to the engine bed only by four bolts and can be hoisted away from above without dismantling any parts of the plane; the engine bearers are provided with permanent feet so that the entire unit can be set on the ground without damage to the radiators, crank case, pumps, etc.

The engine fitted at present is a 450 H. P. Napier Lion, but owing to the arrangement of the wings and the engine bed it is possible to fit practically any other engine, such as the Liberty, with very little alteration and without affecting the balance.

Leading dimensions and weights:

Span upper plan—	59 ft. 9″
" lower plane—	34 ft. 6″
Cord upper plane—	7 ft. 10″
" lower plane—	5 ft. 10″
Length over all—	39 ft. 5″
Height —	10 ft. 9″
Weight empty —	4000 lbs.
Weight loaded —	5760 lbs.
Gasoline capacity—	120 gallons
Speed	120 m. p.h.

Take-off, fully loaded, 20 seconds.



The 1000 H.P. Avro-Napier Bomber

The 1,000 H. P. Avro-Napier Bomber

By Major F. A. de V. Robertson

ON Dec. 15th the first aeroplane in the world to be driven by a 1,000 h. p. engine made its trial flight at Hamble aerodrome near Southampton. This great Napier engine is known as the "Cub", being, so to speak, the offspring of the famous 450 h. p. Napier "Lion". The "Cub" is an X-shaped engine, each limb of the letter being represented by a row of four cylinders, making 16 cylinders in all. Its length from front to rear is 7 ft. 6 inches. Its weight is 2,200 lbs. without water or fuel, and as it will undoubtedly develop at least 1,100 h. p., it weighs no more than two lbs. per horse power developed. The engine is the property of the British Air Ministry, and consequently it is not permissible to give more details about it, but some idea of its efficiency may be gained by pointing out that a locomotive engine of similar power would weigh over 147,800 lbs.

The aeroplane designed for this monster engine is a product of the firm of A. V. Roe & Co. Ltd. It seemed particularly fitting that this firm should be chosen to design and build the first machine to take a 1,000 h. p. engine, for Mr. Roe was the first man to fly in Great Britain in a British-built airplane. He accomplished this feat in 1908 in a triplane of his own design and construction, in which he installed a 9 h. p. J. A. P. engine. He is thus also the only man to have flown with a 9 h. p. engine; and his career from the days of 9 h. p. to those of 1,000 h. p. is one of the romances of modern science. In 1906 he was one of the few men in Britain who believed in the first reports of the success of the Wright Brothers, and he made bold to write to them. He was very proud when he got a reply from Wilbur. He wrote on the subject of their flights to the "Times" also, and incidentally described his own experiments. The paper in publishing his letter added the comment:—"It is not to be supposed that we in any way adopt the writer's estimate of his undertaking, being of the opinion, indeed, that all attempts at artificial aviation on the basis he describes are not only dangerous to human life, but foredoomed to failure from an engineering standpoint." When the first British flying meeting was held at Blackpool in 1909, Roe took his triplane there, but the weather was too boisterous for the 9 h. p. J. A. P., and the machine would not leave the ground. Friendly press critics, some in sorrow and some in anger, advised him to copy the French designs. One wrote contemptuously in his paper of Roe's "astonishing optimism", his "inability to take a leaf out of the book of our successful neighbors across the Channel", and his "unwillingness to build on the lessons of other experiments". Fortunately for all concerned, Roe stuck to his own theories. In 1910 he visited the United States by invitation and attended the flying meeting at Boston, where he crashed badly. He was very kindly received by President Taft. It was not his first visit to your country, for he had first gone there in 1893, and again in 1906 when he was employed as engineer and draughtsman by S. L. O. Davidson, who was trying to produce a sort of helicopter at Montclair. The first item in the press cutting book of the Avro firm is an extract from the "Denver Times" of June 12th, 1906, describing this incident in Roe's career. It is headed by a fanciful picture of a future flying machine, a monoplane with deep fuselage and high-lift wings, which looked very strange a few years ago, but now appears as a highly intelligent antic-

Bert Hinkler, Test Pilot

ipation of events which do not seem at all improbable. The rows of windows indicate that there is more than one deck inside, and the Avro bomber which is the subject of this article has actually got two decks.

Later in 1910 Roe designed a tractor biplane which set the fashion to the world for several years and is still the most popular type of aeroplane. In 1912 he brought out the famous 504 type of Avro, still very widely used as a training machine for embryo pilots.

The latest product of the Avro works is strangely unlike the familiar 504K. For one thing, it is almost entirely built of steel. The wings are well swept back, in the fashion which one associates with the German Taubes, which used to intrigue us in the early days of the war. As the photographs show, it is a tractor biplane with monoplane tail, while the undercarriage has four wheels, a system usually only adopted in the case of twin-engined aeroplanes. The lines are beautifully clean, and even before the trial flight one felt certain that the machine would perform well.

Avro-Napier 1000 H.P. Bomber

The pilot who tested it, little Mr. Bert Hinkler, is an interesting personality, who has well deserved the distinction, which he now holds, of being the first man to fly a 1,000 h. p. engine. He is an Australian from Bundaberg in Queensland. In 1920, he bought the original Avro Baby with 35 h. p. Green engine, an engine which has been used by Roe in 1910, and in that summer made a non-stop flight from London to Turin, 600 miles in 9½ hours, on 20 gallons of petrol. Then he shipped his Baby to Australia and there made a longer and faster non-stop flight from Sydney to his native Bundaberg, just to see his home and his parents. His inches are not many, and he looks just the man to tuck himself inside an Avro Baby. When he climbed up the ladder to the cockpit of the 1000 h. p. bomber he made the onlookers realize more fully than they had done the massive proportions of the machine and engine.

The trial flight was entirely successful. The Avro showed a good climb and gave promise of easy manœuvrability. Hinkler said afterwards that she is a very nice machine to fly and very delicate on controls. If she proves as nimble in the air as is expected, she will be able to carry out bombing raids without any escort of scouts or fighters. She will be heavily armed of course and will carry two pilots, while the petrol tanks used are self-sealing and will neither leak nor catch fire if pierced by bullets. Therefore she should be able to hold her own against a number of enemy aircraft. All will hope that she will never be used for war in our time—but if we attempt to look into the future, what terrible monsters of the air are we to include in the picture?

Resume of Progress of Aeronautical Matters in Congress

THE Aeronautical Chamber of Commerce has prepared the following bulletin covering the progress of aeronautic matters in Congress:

Dec. 4 *House.*

Helium resources of the U. S. would be conserved under a bill introduced on May 4, 1922, by the Chairman of the House Committee on Military Affairs and now pending before the Committee on Public Lands. During the week of hearing upon the bill at which tes- December 4, the committee held a timony was received from members of the scientific staff of the Bureau of Mines. Other hearings may follow during the week of December 11, at which time the committee may hear representatives of the air forces of the military and naval establishments (HR-11549) (From Chamber of Commerce of the U. S. Legislative Bulletin No. 77)

Dec. 5 *Senate.*

Annual report of the National Advisory Committee for Aeronautics transmitted by the President. S. Doc. 270.

Dec. 6 *House.*

Annual report of National Advisory Committee for Aeronautics transmitted to the House.

Dec. 7 *House.*

Mr. Hicks, a bill (HR-13238) to authorize the Secretary of the Navy to procure, purchase, manufacture or construct additional aircraft for the Naval Establishment; to the Committee on Naval Affairs.

Dec. 9 *House.*

Reports of Committees on Public Bills and Resolutions. Mr. Hicks:

Committee on Naval Affairs (HR-13238. A bill to authorize the Secretary of the Navy to procure purchase, manufacture, or construct additional air craft for the Naval Establishment, without amendment (Rept. No. 1269). Referred to the Committee of the Whole House on the state of the Union.

Dec. 11 *House.*

Petition 6566. By Mr. Kissel: Petition of National Aeronautic Association of the U. S. of America, Washington, D. C. on a national policy for air; to the Committee on Interstate and Foreign Commerce.

Dec. 12 *House.*

Executive Communications Nos. 821, 822, and 823. Letters from the Chairman of the National Advisory Committee for Aeronautics giving items of expense of the N. A. C. A.

Dec. 14 *House.*

In discussing Naval Appropriations bill (HR-13374) Mr. Lanham asked the amount of money to be expended on helium in the Bureau of Aeronautics appropriation. $500,000 was the amount.

Dec. 16 *House.*

Mr. Campbell of Kansas submitted a privileged report House resolution 466 (Rept. No. 1280) "Resolved, That during the consideration of the bill HR-13374 making appropriations for the Navy Department and the naval service for the fiscal year 1924, it shall be in order to consider without the intervention of a point of order, provisions of the bill or amendments thereto relating to appropriations to procure, purchase, manufacture or construct additional aircraft for the Naval Establishment, including the necessary spare parts and equipment therefor, at a total cost not exceeding $5,798,950, and also that part of the appropriation bill on page 55, lines 12 to 17 inclusive."

House.

In the Naval appropriation bill (HR-13374) a total sum of $14,647,174 was allotted to the Bureau of Aeronautics.

The Army's Man-less Airplane

FOUR years since the armistice, and more, yet only now has it been possible to acquaint the American public with any details whatever of the automatic pilot-less airplane developed during the war and subsequently to a point of satisfaction as far as its mechanical operation is concerned.

The Army Air Service has now completed its long series of experiments, beginning during the war, in the endeavor to produce a small airplane, of a span of 20 feet, with 60 h.p. air cooled engine, capable of carrying a useful load of 250 lbs., which would take-off, climb to any predetermined height, level out, maintain that level and lateral and longitudinal equilibrium, and steer a straight course, barring side drift, without a pilot aboard.

The automatic airplane has no need of a horizon and functions equally well in fog and in clouds as in clear weather. By comparison with human piloting the machine is observed to take a straighter and steadier course as soon as the automatic control is thrown into action.

In 1911 the Sperry Gyroscope Co. began experimenting with an automatic pilot and by 1913 had perfected an apparatus which, though delicate and complicated, functioned. In 1914 the Sperry device won a prize for the development in a series of tests in France, against a large number of competitors. The device was worked upon then as a means of safety and to relieve a pilot of fatigue on long flights. The gyroscope was the foundation of the system.

In the Army's device, two separate and distinct gyroscopic units are used in the stabilizing and the maintaining of the course. These gyroscopes are electrically driven from a generator geared to the engine and run continuously during flight. The sense of direction, whether vertical, horizontal or fore and aft, is taken from its respective unit and transmitted by means of leakage ports in the pneumatic system which in turn controls relay valves delivering a suction to the power pneumatics. These relay valves and tubes controlling this supply of power correspond to the nerves in the human body. The power pneumatics are directly connected to the control surfaces of the airplane and the supply of vacuum is maintained by a pump, gear driven from the airplane engine.

The gyroscopes function as the brain, the relay valves and tubes as the nerves and the power pneumatics as the muscles.

Taking-off automatically, climbing to a predetermined height, and maintaining this altitude is accomplished by changing the relation between the vertical position of the gyroscope controlling horizontal flight and the normal horizontal position of the plane. This is done mechanically by the use of evacuated diaphragms, which by their gradual expansion upon increase in altitude, operate a relay valve. In other words, in setting up the machine for flight this mechanism is so adjusted as to give the "brains" or gyroscope controlling the horizontal flight a slightly biased view of just what is horizontal, thereby allowing the plane to climb at a slow rate. When the desired altitude is reached the diaphragms have expanded a known amount, due to the rarefied atmosphere, throwing into action the corrective mechanism, which immediately "levels off" the plane and from that time on until the termination of the flight the plane flies in a perfectly horizontal position, neither gaining nor losing altitude.

The take-off is slightly different from that of the human pilot, in that as soon as the engine is opened up, the airplane assumes its position of normal slow climb and in this position runs over the ground, gaining speed until it finally rises.

Another feature that has been developed is the distance log or gear. This is an air fan, registering distance of advance for a given number of revolutions. The desired distance of flight is scaled from an accurate map and corrected for windage. This is set on the distance gear before starting and correctly measures the desired length of voyage.

In actual work, hundreds of take-offs have been made, with automatic flights up to 90 miles in length.

This pilot may be mounted in any type airplane.

A group of any number of these, loaded with explosives, could be directed on their course by radio from a human-piloted guide plane and steered to their mark. During the war this country found it possible to guide large bombs by radio while falling, it will be recalled. One can easily imagine a machine like the Sperry messenger with an explosive load in place of the human pilot.

The N. A. C. A. Three Component Accelerometer

THE Accelerometer is one of the new instruments designed by experts of the National Advisory Committee for Aeronautics for use in experimental research on aircraft in *free flight*. It is a device for obtaining the magnitude of the load factors in flight and for procuring information on the behavior of an airplane in various maneuvers. A series of articles on these instruments was begun in the December issue of *Aerial Age*. All these are of profound interest to students and designers, pilots and manufacturers. If instruments such as these were on the market they would be found of extreme value by every experimental plant and manufacturer in the world.

When an airplane is flying on a straight and level course a spring scale with a 1-pound weight attached to it would record 1 lb. If, however, the plane were put into a turn or a zoom, the scale would no longer record 1 lb. but may record 2 or 3 lbs.—e.g., the apparent weight of objects on the airplane has increased several times. Should the stick be suddenly shoved forward to put the machine into a dive, the spring scale may read zero—e.g., an object on the plane might have no weight. When a spring scale is used in this way the pound graduations on the scale represent accelerations in terms of the acceleration of gravity, g, which is in English units about 32 ft. per sec.

If the average loading of the wings is 10 lbs. per sq. ft. in level flight, during a maneuver in which the spring scale reads 3, the wings would then be carrying a load of 30 lbs. per sq. ft. The readings of the accelerometer, therefore, give the loads that the airplane structure must undergo during a maneuver and also the load that the pilot and passengers experience. Every pilot knows he is pushed down into his seat during a tight spiral, for instance, and it is almost impossible to stand up or lift the feet from the floor. During violent stunts a 180-lb. man may increase in weight to as much as 800 lbs.

Accelerometer Shows Ability of Pilot

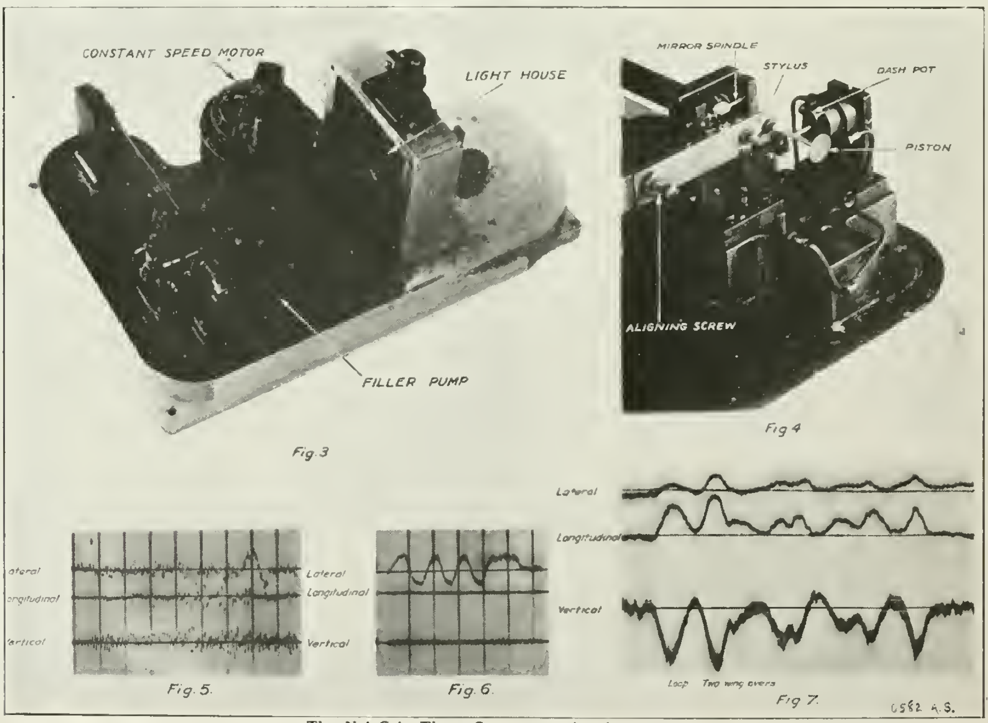
The accelerometer records are of value to the designer as they show him what stresses the airplane structure undergoes and how long these stresses last. The records also show clearly the pilot's ability, especially in stunts and landings, so that an accelerometer should be an excellent means of examining a flier, as it gives a clear and unbiased record of his handling of a machine. Here the insurance companies are interested.

Description of the Instrument

This new instrument measures and records accelerations along three mutually perpendicular axes. Previous instruments have only recorded accelerations in an airplane along a single axis. In order to measure the acceleration along the three axes of an airplane simultaneously it is necessary to have three accelerator movements, each mounted perpendicular to one of the axes. These three movements, for convenience, have been incorporated in one instrument.

Photographs and diagrams are shown in Figs. 1-4. The construction, as may be seen from Fig. 3, is similar to the other standard N. A. C. A. instruments, which make their records with a pencil of light deflected by a mirror on a film in the same manner as movie films now record speech. The new device like its companions uses an optical system, recording drum, and driving motor.

There is a light source consisting



The N.A.C.A. Three Component Accelerometer of a single lamp, so that the three mirrors form separate images on a single film. The three curves are distinguished from each other by means of a revolving shutter which gives a dotted and a dash record from two of the mirrors. As in the case of the other instruments there is a timing lamp to synchronize the records and to give time intervals.

The principal features are shown in Figs. 1 and 2. Fig. 1 shows the arrangement of the three springs and the corresponding axis along which each records the acceleration. The motion of the end of each spring is transmitted by the stylus—a small pointed screw—to the mirror as shown in Fig. 2. The X and Z springs register directly, but the motion of the Y spring must be transmitted through a bell crank. The moving parts are made very small and light to reduce their moment of inertia and a hair spring on each mirror spindle takes up all backlash.

To adjust the sensitivity, the spring may be moved along its own axis or the weight of the screw near the free end may be changed. This screw is also used to align the axis of the spring, that is, to make the axis parallel to one of the three mutually perpendicular faces milled on the case. By moving the screw in or out or adding a small weight to either side, the effective axis of the spring is thus shifted. The zero is adjusted by means of the stylus.

The motion of the springs is damped by a small dash pot on the end of each, as shown in the Figs. 3 and 4. Three dash pots have a very close-fitting vane and the clearance around the stem is kept as small as possible in order to prevent the leakage of oil. For convenience in filling, each of the three dash pots is connected by a small hypodermic tube to a pump which fills all simultaneously.

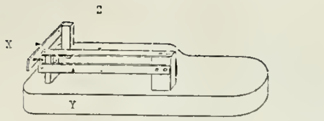


Fig. 1. Showing the arrangement of the springs and the axes of the instrument.

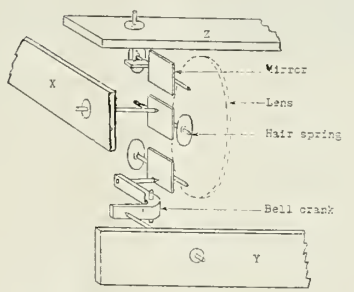


Fig. 2. Showing the means for transferring the motion of the springs to the three mirrors. The dash pots are omitted.

Precision

After manufacture, the instruments are calibrated, and the accuracy of the instrument as used in the air is determined then by the accuracy with which the records can be scaled. The records can easily be measured to 0.01 inch, which corresponds to 0.12 second of time. The acceleration normal to the wings may be measured to 0.04 g. and the lateral and the longitudinal to 0.025 g., the difference being due to sensitivity of the springs.

Records

Fig. 7 shows a record taken in the air with no timing intervals and before the damping on the Z spring was improved. The first part represents a loop and the second two wingovers in quick succession. It will be noticed in the loop that the acceleration along the Z axis is about 3 g., the normal position of the zero line being 1 g. The acceleration at the top of the loop is less than normal, but never reaches zero, as there was no tendency to hang. The longitudinal acceleration is 0.75 g., or approximately 24 ft./sec.[2] (deceleration). In these maneuvers there was very little lateral acceleration and it is thought that it may be necessary to change the sensitivity of the X spring. In any case, the sensitivity of the springs may be readily changed to suit the problem in hand.

Summary of Some Records

The following table gives the maximum acceleration found in various maneuver:

Maneuver.	Machine.	Maximum acceleration.
Porpoise landing	JN-4H	5.25 g.
Pancake, 4-foot drop	JN-4H	4.95 g.
Loop	JN-4H	3.68 g.
Roll	JN-4H	4.20 g.
Spin, maximum in pulling out	JN-4H	3.12 g.
Spin	DH-4B	2.78 g.
Do	Bristol	2.72 g.

From these figures it would seem that in no reasonable stunt would the air load ever exceed 4.5 g. A normal landing should not give more than 3 g., and a very rough landing will seldom exceed 5.5 g. It is quite possible that on a high-speed scout machine, higher loadings than these would be experienced in stunting, but the accelerometer records taken by the Bristol in mock fights show no loads in excess of 4.5 g.

(*Concluded from page 58*)

job of making the improvements which will guarantee economic performance, reliability, longevity, and safety in automotive equipment as applied to air navigation. And then the people of the country will have the job of adapting aircraft to the economic and commercial phases of our national life. Once given the safe and economical aerial vehicle, the public will find many uses for it.

Second Annual Aeromarine Report

The operation of the Aeromarine-Navy Flying Boats in the Commercial Transportation of passengers, mail and freight for the period commencing November 1st, 1921, and ending November 1st, 1922, is herewith submitted:

SOUTHERN DIVISION:

268,535 passenger miles were flown in 744 flights and 2,399 passengers carried.

The services maintained included Key West, Havana, Miami, Bimini, Nassau and Palm Beach, also special flights from New York to points in Florida and Cuba.

NEW YORK DIVISION:

57,658 passenger miles were flown in 807 flights, and 2,380 passengers were carried.

The services maintained included New York, Atlantic City, New York-New England points, and New York-Aerial Sightseeing.

GREAT LAKES DIVISION:

412,854 passenger miles were flown in 574 flights, and 4,388 passengers were carried.

The services maintained included a double daily service between Cleveland and Detroit; sightseeing flights on Lake Erie and Lake St. Clair; also special flights from New York to Cleveland and Detroit via Albany, Montreal and Buffalo.

1. Three types of flying boats were used in these operations:
   - 11-passenger flying cruisers, F5L type
   - 6-seat converted Navy Coast Patrol Boats, HS2L type
   - 3-place Aeromarine flying boats;
2. Not a single passenger or employee was injured during these operations.

TOTALS:

Passengers carried	9,107
Passenger miles flown	739,047
Number of flights made	2,125
Accidents	NONE

SUMMARY:

These figures added to those of our first year's operations show a complete total of more than 1,000,000 passenger miles flown, and more than 20,000 passengers carried without a single accident.

AERIAL AGE

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The Civil Aeronautics Act

VERY definite progress has been made in furthering air legislation. The Hon. Samuel E. Winslow, chairman of the House Committee on Interstate and Foreign Commerce, introduced on January 8th the Civil Aeronautics Act of 1923. Commenting on the Bill Mr. Winslow said:

"The Civil Aeronautics Act of 1923, as introduced by me in the House today, is the mature result of months of inquiry into our need for basic legislation in this new and important field.

"The Wadsworth Bill which passed the Senate last February contained the elements of the desired legislation, but after being referred to the Committee on Interstate and Foreign Commerce of the House, I realized that the subject was so vital in its relation to the future security and prosperity of the nation, that inquiry into every angle was necessary. Thus, with the sympathetic co-operation of Secretary Hoover and Dr. Klein, Chief of the Bureau of Foreign and Domestic Commerce, I have gone thoroughly into the subject.

"It was soon apparent that it would be necessary to redraft the proposed legislation in respect of constitutional questions involved; the situation presented by the International Air Navigation Convention; certain departmental differences; the adaptation of the existing customs, immigration, public health and other regulatory legislation to air travel; some necessary administrative details, as well as certain questions in respect of torts, crimes and court jurisdiction of matters relating to air navigation, as well as questions of form, arrangement and clarity. Mr. Frederic P. Lee of the Drafting Service of the House, now Chief Draftsman of the Senate Drafting Service, was requested to make a thorough comprehensive study of the situation. The bill has been constructed under his advice.

"Representatives of the Commerce, War, Navy, Treasury, Post Office and Labor Departments, National Advisory Committee for Aeronautics and such civilian organizations as the Aeronautical Chamber of Commerce, National Aeronautic Association, Society of Automotive Engineers, National Aircraft Underwriters Association, as well as the Aviation Committee of the American Bar Association, and the Commissioners on Uniform State Laws, have participated in our conferences. The bill as introduced by me today is the result. We believe that it will meet the needs adequately and constructively.

"The Act, in brief, provides for the establishment in the Department of Commerce of a Bureau of Civil Aeronautics. The Act is divided into five parts and establishes authority for the inspection and licensing of aircraft and pilots, establishing and certifying air routes and terminals, as well as rules of the air and their administration and so co-operating with our Military, Naval, Postal and Commercial air activities that the whole can literally be co-ordinated into the Air Power of the United States. Aviation is, perhaps, the most significant mechanical development of this generation, contributing as it does to the speeding up of transportation and forming the key of our national defense on land and sea.

"In his inaugural message, President Harding urged legislation for the regulation, relief and encouragement of aviation. The establishment and development of Civil Aeronautics has the endorsement of the administration. The basis of Air Power must be a healthy, self-supporting aircraft industry. Among the needs of this industry are increased public confidence, increased capital and more favorable insurance rates. Public confidence will expand as the hazard of aviation diminishes. Capital undoubtedly will enter the field as soon as our basic law governing the operation of aircraft is established upon a sound and broad basis, and under responsible management and direction and reduced hazards, reasonable insurance rates will follow. It is confidently expected that the proposed Civil Aeronautics Act of 1923 will solve practically all of these problems."

Great credit is due the Aeronautical Chamber of Commerce in securing this much desired action on the part of Congress.

Our Too-Free Air

BEFORE steamboats and motor-driven craft can begin to navigate they must be inspected by government authorities to make sure that their seams won't open or their engines blow up at inopportune moments. Steamboat pilots, too, must be examined and passed by government authorities, so that boats won't be piloted by persons who may carelessly run them ashore or into other boats. The person who failed to grasp the need of such inspections and examinations would be almost universally regarded as somewhat weak in the head.

All over the United States today, however, there are civilian aviators whose knowledge of flying is imperfect. These aviators are not under government control. They can fly when they like and where they like. The machines in which they fly are not inspected by the Government. Consequently they can take up any machine that can be coaxed to leave the ground. As a result many of them fly in machines that should be strictly confined to the junk heap. In these machines civilian aviators fly blithely over large cities, swoop gayly over masses of people that congregate at fairs and football games, and take up passengers to whom all airplanes look alike. Only a few states and cities have passed regulations forbidding planes to be flown over crowds at low altitudes, though army regulations strictly forbid military aviators to do it.

If the boilers of a steamship explode, or if she is run on the rocks by an unskilled pilot, there is an excellent chance that the passengers will escape unscathed. If an airplane breaks in midair, or an unskilled aviator loses control of his plane, there is scarcely a chance of escape; nor are the city and the people beneath in a particularly enviable position. The need for a law putting the control of civilian airplanes and aviators into the hands of the Federal Government is imperative.
Editorial in the Saturday Evening Post

Howard E. Coffin, Pres. B. H. Mulvihill, V. Pres. B. F. Castle, Treas. John B. Coleman, Rec. Sec.

Official Bulletin of National Aeronautic Association of U. S. A.

Col. H. E. Hartney, General Manager Cable Address, Nataero
National Headquarters, 26 Jackson Place, Washington, D. C.

The National Aeronautic Association of U. S. A. assumes responsibility for the statements under this heading

BY COURTESY of *Aerial Age* the National Aeronautic Association of U. S. A. is permitted to present to its members and to the public-at-large, the roster of the Officers, Governors, and Committee Members of the National Headquarters and the nine Districts throughout the country.

The President of the Association is Howard E. Coffin of Detroit, Vice President of the Hudson Motor Car Company, formerly a member of the Naval Consulting Board, Council for the National Defense, Aircraft Production Board, and the American Aviation Mission. Mr. Coffin's business address is—Hudson Motor Car Company, Detroit, Mich.

The Resident Vice President is Bernard H. Mulvihill of Pittsburgh, President of the Natural Gas Conservation Company. He was an Officer of the 107th Field Artillery and the U. S. Air Service. His business address is B. F. Jones Building, Pittsburgh, Pa.

The Treasurer of the Association is Colonel Benjamin F. Castle, an Officer of the Irving National Bank, New York, a graduate of U. S. Military Academy at West Point, and was Lieut. Colonel in the Army Air Service, and Aviation Attache to the U. S. Embassy at Paris. His business address is: Irving National Bank, New York, N. Y.

John B. Coleman, Recording Secretary of the Association, is a broker and manager of the John B. Coleman Company of Sioux City, Iowa. He was a Second Lieutenant and Observer in the Army Air Service during the war. His business address is 305 Metropolitan Building, Sioux City, Iowa.

FIRST DISTRICT

The First District of the National Aeronautic Association comprises the states of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut. Porter Adams, the Vice President and Governor is an Engineer and President of the A. I. D. Inc., Developing Engineers. He is a graduate of the University of Redlands, California and of the Massachusetts Institute of Technology. He was an officer in the Naval Aviation force during the war. His business address is—1352 Beacon Street, Boston, Mass.

Godfrey L. Cabot, Second Governor of the First District is one of the oldest Pilots in the country, is a manufacturer and, during the war was an officer in the Naval aviation forces, and Commanding Officer at the Marblehead Aviation Camp. Mr. Cabot has been identified with aeronautical activities in this country for many years. His business address is 940 Old South Building, Boston, Mass.

SECOND DISTRICT

The Second District of the Association comprises New Jersey, New York, Delaware and Porto Rico. John D. Larkin, Jr., of Buffalo, N. Y. is the Vice President & Governor of this District. Mr. Larkin is a manufacturer, and is President of the Larkin Company of Buffalo. During the war Mr. Larkin was active in war work having turned over his entire industry to the work.

His business address is—Care of the Larkin Company, Buffalo.

THIRD DISTRICT

The Third District of the Association comprises Maryland, Pennsylvania, Virginia, and District of Columbia. The Vice President and Governor of this District is Mr. L. F. Sevier of Pittsburgh who is a well-known automobile man. His business address is Forbes & Craig Sts., Pittsburgh, Pa.

Mr. R. J. Walters, the Second Governor of this District is President of the Tire Corporation, and a Director of the National Tire Dealers Association. Mr. Walters was a Captain in the Army Signal Corps during the war. He is the owner of a seaplane transportation company operating from Baltimore. His business address is 500 Pennsylvania Avenue, Baltimore, Md.

FOURTH DISTRICT

The Fourth District of the Association comprises Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina and Tennessee. The Vice President and Governor of this District is Mr. L. Sevier, who is President of the Alabama Manufacturers Association and who has been connected for many years with the railroads and the steel manufacturing business in the South. His business address is care of the Alabama Manufacturers Association, Birmingham, Ala.

Van Hampton Burgin is Second Governor of this District and is a member of the firm of Burgin & Moore, Insurance. During the war Mr. Burgin was in the Army Air Service, 13th Aerial Squadron, 2nd Pursuit Group; fought on the Toul Sector and St. Mihiel drive. His business address is 217 Healy Bldg., Atlanta, Ga.

FIFTH DISTRICT

The Fifth District of the Association comprises Indiana, Kentucky, Ohio and West Virginia. The Vice President and Governor of this District is Glenn L. Martin, an airplane manufacturer of Cleveland, Ohio. Mr. Martin began building airplanes in 1907 and has been a flyer since 1908. He won a medal for an over-ocean flight from Newport to Catalina, California in 1912. His business address is 16800 St. Clair Ave., Cleveland, Ohio.

Mr. Dudley M. Outcalt, Second Governor of the Fifth District is a lawyer and was an officer in the Air Service, serving with 90th, 141st, 95th and 94th Air Squadrons, and later, with the Army of Occupation in Germany. His business address is Traction Building, Cleveland, Ohio.

SIXTH DISTRICT

The Sixth District of the Association comprises the states of Illinois, Michigan and Wisconsin. The Vice President and Governor of this District is Mr. Charles S. Rieman, the President of the Elgin Motor Car Corporation, and the President of the Chicago Aeronautical Bureau. His address is 22 West Monroe Street, Chicago, Illinois.

The Second Governor of the District, Sidney D. Waldon, President is of the Detroit Aviation Country Club and Vice President of the Detroit Motor Bus Company. During the war he was one of the group who produced the Liberty Motor. He was a member of the Aircraft Production Board and Assistant Chief of the Equipment Division Signal Corps, and served with the Army Air Service as Colonel in France. His address is 4612 Woodward Avenue, Detroit, Mich.

SEVENTH DISTRICT

The Seventh District of the Association comprises the states of Arkansas, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota and South Dakota. Ralph W. Cram, the Vice President and Governor of this District is the Editor of the Davenport, Iowa, Democrat and Leader. Mr. Cram has been identified with Aviation activities for many years and has written much on the subject of aeronautics. He is a leader of aviation activities in the middle west. His business address is Davenport, Iowa.

Mr. Howard F. Wehrle, Second Governor of the Seventh District, is District Manager for the Kinear Manufacturing Company, and also President of the Flying Club of Kansas City. He served in the Army Air Service during the war in this country and over seas in the rank of Major. His business address is 503 Railway Exchange Building, Kansas City, Mo.

EIGHTH DISTRICT

The Eighth District of the Association comprises the states of Arizona, Colorado, New Mexico, Oklahoma and Texas. The Vice President and Governor, Edgar C. Tobin of San Antonio, Texas, is engaged in the automobile business in that city, as sales manager for the Hudson & Essex Distributor Company. During the war, Mr. Tobin was first with the Lafayette Escadrille, and then in the Army Air Service. He is an Ace and is credited with the destruction of six enemy planes. He has been decorated with the Croix de Guerre, and the D. S. C. by the United States. His address is Roman & Oakland Streets, San Antonio, Texas.

The Second Governor of this District is Wm. Long who was a flyer in the Army Air Service, and who travels extensively by airplane. Mr. Long flew last fall to the Detroit Aviation Meet from San Antonio, Texas.

NINTH DISTRICT

The Ninth District of the Association comprises the states of California, Idaho, Montana, Nevada, Oregon, Washington, Wyoming, Utah, and also Alaska. The Vice President and Governor of this District is P. G. Johnson, who is connected with the Boehing Aircraft Corporation. His business address is 2432 North Broadway, Seattle, Washington.

Mr. C. H. Messer, the Second Governor of this District is an electrical engineer, and is the President of the U. S. Aircraft Corporation, conducting a commercial aviation business in the northwest. He was a pilot and instructor in the Army Air Service during the war. His business address is 1302 West Second Avenue, Spokane, Washington.

GOVERNORS-AT-LARGE

The Association, in accordance with its

(*Concluded on page* 89)

THE NEWS of THE MONTH

Federal Aeronautic Control

Colonel W. Jefferson Davis, California Lawyer, who represented the War Department, as special counsel, at the Congress on International Aviation Legislation at Prague, is in Washington co-operating with Congressional Committees on the proposed Federal bill governing Aeronautics.

While in Europe, Colonel Davis was attached to the American Embassy at Berlin, as legal advisor to the Military Attache, and after the conclusion of his detail for the War Department, made an extensive study for the American Bar Association of Civil Aviation in Great Britain, France and Italy.

Colonel Davis is counsel for the newly formed National Aeronautic Association, and a member of the Aviation Committee of the American Bar Association.

For several years he has endeavored to bring about Federal legislation for the Air Service. The proposed Federal bill will create a Bureau of Civil Aeronautics in the Department of Commerce.

Colonel Davis states that, "Congress is faced with the immediate necessity of enacting Federal legislation providing for uniform air laws. The only surprising thing is that this country, a pioneer in flying, should be so long without vision in solving fundamental questions of jurisprudence for the control and regulation of flying. Such a Federal bill, if passed, will become the charter for civil aviation, and will be a basis for the control and sovereignty which the Federal Government can, and should, properly exert over the air.

"In 1917 the nervous energy of the American people expressed itself in preparing its young manhood for service at the front. In the immediate future, this same energy and activity should be expressed in training the youth and talent of the country for efficient service in the air, not only for national defense, but for commercial enterprise.

"The airplane will be a most important link in future national defense. Commercial projects, with airships and airplanes plying between the larger cities of the country will spring into being, as soon as Federal legislation is secured. Commercial aviation has long since passed the experimental stage, and there is immediate necessity for well defined laws governing aeronautics. Early action by Congress will have a marked effect in the development of a new transportation industry."

Sesqui-Centennial Exhibition

The Sesqui-Centennial Exhibition to be held in Philadelphia in 1926 will include a great airplane building with an aerodrome for exhibition purposes, demonstrating world achievement in the navigation of the air.

St. Louis Wants 1923 Air Races

Major Howard F. Wehrle, Vice-President of the Air Terminal Association of Kansas City, Mo., and a Governor of the National Aeronautic Association, was a guest at a dinner tendered two weeks ago by the St. Louis committee seeking to obtain the 1923 National Air Races. At the meeting of the N. A. A. governors in New York Jan. 15th, Major Wehrle will make a report on facilities and preparations for the proposed meet at St. Louis.

Lieut. Tinker with N.A.A.

Clifford B. Tinker, director of publicity for the National Aeronautic Association, (headquarters at 26 Jackson Place, Washington, D. C.) has an interesting article in the December number of "Our World" Magazine. Mr. Tinker was formerly aide to the Chief of Naval Aviation.

American Legion for Commercial Aviation

At its national convention in New Orleans, October 16th-20th, 1922, the American Legion adopted a resolution providing for an American Legion Committee of Aeronautics, "whose functions it shall be to so co-operate with the U. S. Army Air Service and other nationally recognized institutions and organizations devoted to the interests of Aeronautics, and through the medium of our local posts, country and state organizations and national organization, to arouse the interest of the people in the developments of commercial aviation, at such times and places as conditions and circumstances may warrant." The resolution further provided that the committee consist of five members, appointed annually by the National Commander, and serving without pay. Major Reed G. Landis, of Chicago, son of Judge K. M. Landis, has been appointed Chairman of the committee. On Major Landis' invitation, the Aeronautical Chamber of Commerce is co-operating with the Committee and is supplying it with data and reports from time to time.

Philadelphia as an Airport

At a joint meeting last night of the Engineers' Club and the Aero Club of Pennsylvania, at Philadelphia, a movement was launched to make Philadelphia one of the greatest airports in the United States and the world. The subjects under discussion at the meeting were "Air Terminals" and "The Model Airway" Mr. Archibald Black of Garden City, N. Y. aeronautical engineer and chairman of the Safety Code Subcommittee for Maintenance and Equipment of Airplanes, addressed the meeting on the subject of landing fields for both airplanes and seaplanes. Mr. Arthur Halstead, Bureau of Standards, Washington, Assistant Secretary, Sectional Committee for Aeronautical Safety Code, spoke on landing fields and seaplane stations, with particular reference to the city of Philadelphia. Captain Burdette S. Bright, U. S. Army Air Service from the War Department, Washington, showed for the first time the new moving picture of "The Model Airway".

The meeting was attended by Vice-President B. H. Mulvihill, Conway W. Cooke, Chairman, Membership Committee, and C. T. Ludington, of Philadelphia all of the National Aeronautic Association, and jointly with the Engineers' Club and Aero Club, steps were taken to form the Philadelphia Bureau of the National Aeronautic Association, the

Bureau to be made up of delegates from the Boards of Trade, Chambers of Commerce, Civic Clubs, Engineers' Clubs, Manufacturers' Clubs, the Aero Club, and representatives of the city government. With such backing it is believed that a model airport will be established in Philadelphia within the next twelve months, this airport to accommodate land planes and seaplanes, and have available space for the erection of a mooring mast for rigid airships, when such ships are placed in commission in this country.

Contest Committee N.A.C.A.

Announcement is made by the National Aeronautic Association of the U. S. A. of a special meeting of the Contest Committee of the Association which discussed the details of next year's Pulitzer Cup Race. The most important facts brought out, included a statement by Commander Jerome Hunsicker, of the Navy's Bureau of Aeronautics, that in tests in England, it has been established that the human system cannot withstand the strain of a turn in which the centrifugal force is greater than four times gravity. This is caused by the heart action being insufficient to force the blood to the brain when this great force has been experienced.

Inasmuch as a violent turn of 90 degrees at a speed of approximately 200 miles an hour, causes a centrifugal force of approximately three times gravity, it was felt that the danger line was being approached, to such an extent that a double pylon turn was essential for the safety of the pilot. Therefore, it was decided that the distance and pylon arrangement of the course for next year's race should be a total length of 200 kilometers, with four laps around a 50 kilometer equilateral triangle, using two pylons at the turns instead of one, assuring a wide turn.

It was also decided to have a single basis for the minimum factor of safety for monoplanes and biplanes, and seven and a half was decided as a satisfactory factor of safety for all parts of the planes.

The maximum landing speed, after due consideration, was decided upon at 75 miles an hour limit, being the same that was used at the 1922 Pulitzer Races last October at Detroit. However, the minimum high speed under which a plane could enter the race was increased to 175 miles an hour. In other words, a plane not capable of flying faster than 175 miles an hour, or nearly three miles a minute, is not fast enough to maintain its position in the race.

A restriction was placed on the contestants, in that they must retain the landing gears originally used. While retractable landing gears will be allowed, no contestant will be permitted to drop his landing gear after once taking the air.

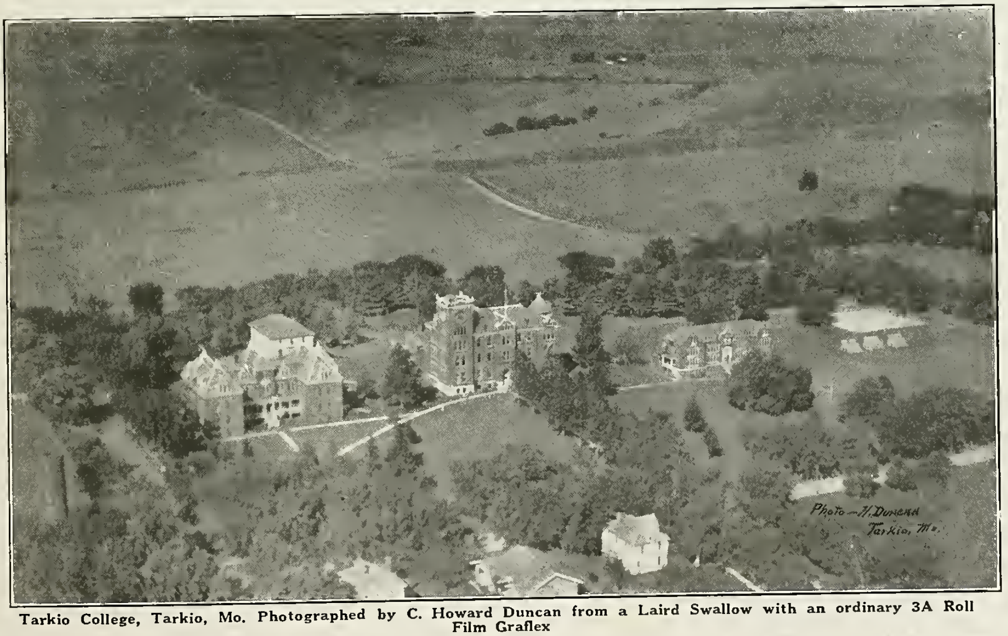
After the experiences at Omaha in 1921 and at Detroit in 1922 it was the consensus of opinion among the committee that the courses to be flown should be over water if possible.

Delegates from the various interested organizations were as follows:- Lieutenant Col. Frank P. Lahm, Chairman, Contest Committee; B. Russell Shaw, Executive Vice Chairman, Contest Committee; B. H. Mulvihill, First Vice President; and Col. H. E. Hartney, General Manager; all of the National Aeronautic Association of U. S. A. The airplane industry was represented by:- Mr. F. H. Russell, President Curtiss Airplane & Motor Corporation; and Commander C. G. Peterson, Wright Aeronautical Corporation; The National Advisory Committee for Aeronautics was represented by its Executive Officer, Dr. George W. Lewis; the Navy's Bureau of Aeronautics, by Commander J. C. Hunsicker, and Commander M. A. Mitsher; the Marine Corps Aviation Section by, Col. T. C. Turner, and the Army Air Service by Major Horace M. Hickam, Major H. A. Dargue, Major I. A. Rader, Captain St. Clair Street, Lieut. A. J. Maitland, (winner of the 2nd Pulitzer Race at Detroit), and Lieutenant T. J. Koenig.

Among the deliberations of the Committee, it was decided that prize money should not be offered for events in which only the Military and Naval Service planes could compete, as for example, the Pulitzer Race. It was suggested that certain sums of money be appropriated for the entertainment of service pilots and to assist them in defraying their expenses, and that at least two events be placed on the program eliminating Government planes and allowing the competition of civilian entries.

While the location of the contest for the Pulitzer Cup Race for 1923 has not been decided upon, a sub-committee was appointed to view localities considered desirable to conduct the races, and representatives of the Army and Navy Air Services will send their representatives on the tour of inspection with the National Aeronautic Association Sub-Committee.

Chicago, St. Louis, New Orleans, Omaha, San Francisco, Los Angeles, and Milwaukee have presented bids for the race, but the selection of the city will be left with the Sub-Committee.



Tarkio College, Tarkio, Mo. Photographed by C. Howard Duncan from a Laird Swallow with an ordinary 3A Roll Film Graflex

Mapping Chicago

The Diggins Aerial Photo Co., has secured a contract to map the district bounded by 26th and 43rd streets and South Park avenue and Clark street Chicago. Work will begin as soon as the weather clears up sufficiently to insure clear pictures.

Model of Giant Airplane

An accurate flying scale model of the huge Zeppelin-Staaken commercial monoplane is on display at the Chicago Aero club rooms in the Auditorium hotel. The model was made by Paul Schiflersmith of the Illinois Model Aero club. The plane it represents is an immense all-metal monoplane with four 250 H. P. Maybach engines built right in the thick wings. The plane has a capacity of 18 passengers.

Huff Daland Aero Corp. Closes Western Office

The Huff Daland Aero Corporation has temporarily closed its western office at 1018 Commerce Bldg., Kansas City, Mo. during the winter months and will carry on its sales work at the Huff Daland Factory in Ogdensburg, N. Y. until the spring flying season commences.

The parent company has been intensively occupied with the development of Army and Navy airplanes ever since the production of their first thick wing biplane in the early fall of 1921, and the advent of the Petrel, the first successful cantilever biplane to be placed upon the commercial market in the United States which made its appearance in the spring of 1922.

The Petrel was quickly followed by the Lawrance motored TA-2 training plane, produced for the United States Army, and the HX-1 training and gunnery seaplane powered with the Wright E-2 motor and developed for the United States Navy.

Both types were completed and fully flight tested during the past summer, the HX-1 being delivered by air on its maiden flight along the all water route from Ogdensburg to Washington, D. C. during the latter part of August, and the company was rewarded in both cases with additional orders for ships of the same general class resulting in the present construction of the HO-1 and TA-6.

Huff Daland & Company is now calling together the men who handled its sales work and commercial flying during the past year with a view to collaborating with them upon the results of the year's flying and completing the "Petrel" for 1923.

American Investigation Corp.

The American Investigation Corp. is proceeding conservatively upon a progressive line of inquiry which assures a substantial structure of information. This investigation includes such vital subjects as the kind of gas to be used and the manner of its production, what, when and where to construct, and a survey through independent sources of probable revenue from the transportation of freight and passengers.

Lawrance Engine Test

Following the excellent showing made by the 200 hp. Lawrance model J radial air-cooled engine in the last Curtiss Marine Flying Trophy race, the winner of which was equipped with this power plant, it is interesting to hear that in a recent endurance test this engine ran for over 200 hrs.

The exact figure was 201 hrs. the last 36 hrs. of which were a continuous run, no stops or adjustments of any kind being made. This last run is the longest on record for an air-cooled engine. The 201 hrs. of running was accomplished without overhaul of any kind, without the change of any of the accessories, including magnetos, spark plugs and wiring. At the end of the run all bearings and bearing surfaces were in excellent condition, barely showing any sign of wear.

For the total run of 201 hrs. the engine developed an average of 182.7 hp. at approximately 1705 r.p.m. with an average gasoline consumption of 0.501 lb. per hp. hr., and an average oil consumption of 0.019 per hp. hr.

A 300 hr. full throttle endurance test is shortly to be begun with a Lawrance J engine fitted with valves of a new type.

New Airplane Co.

A company to manufacture Bellanca airplanes from designs of Prof. J. M. Bellanca has been organized under the name of Roos-Bellanca Airplane Co., Omaha, Neb.

Prof. Bellanca is internationally known as an aeronautical engineer, airplane designer and constructor, whose activity in the field began in 1906. Victor H. Roos, organizer of the company, is a prominent Omaha business man and is one of the largest dealers in motorcycles and bicycles in the middle west.

The first model to be produced will be the Bellanca CF monoplane. It is expected that production of this model will soon be under way and that it will be possible for the company to begin deliveries about June 1923.

International Air Exposition at Gothenburg

The Swedish Government representatives in the United States advise us that the International Air Exposition to be held in Gothenburg, Sweden July 20—August 12, 1923, has attracted important exhibitors from England, France, Germany, Holland, Italy, Czecho-Slovakia, Norway and Denmark. Participation by the United States is greatly desired. Full information, with descriptive booklets, etc., will be sent on request by the Aeronautical Chamber of Commerce.

British Governor Christens American Flying Boat

The christening ceremony of the latest flying boat of the Aeromarine Airways Inc., which has been specially detailed for the Miami-Nassau air service, was performed recently when His Excellency Major Sir Harry Edward Spiller Cordeaux, K. C. M. G., C. B., Governor of the Bahamas formally gave his name to the craft in Nassau Harbor.

According to C. F. Redden, President of the Aeromarine Company with executive offices in the Times Building, New York, Governor Cordeaux broke a bottle of champagne; which was tied with the international colors, red, white and blue, over the bow of the beautiful craft with the words, "I name this flying boat the 'Cordeaux' and trust that under the guiding hand of Providence she may make many successful trips".

Thousands of people watched the ceremony. A guard of honor from the Bahama Police under the Acting Commandant, C. J. Whebell, was drawn up opposite to the landing and the band played the Royal Salute on the arrival of the Governor, who was accompanied by Lady Cordeaux, Roland Rohlfs, Manager of the Miami Division of the Aeromarine Airways, who came over to attend the christening ceremony, Honorable H. E. W. Grant, C. M. G., Colonial Secretary, the Honorable P. W. D. Armbrister, Receiver General and Treasurer, the Hons. Sir Jas. P. Sands, G. H. Gamblin, G. H. Johnson, J. R. G. Young, Members of the Executive Council, the Honorable Harcourt Malcolm, C. B. E., K. C., Speaker of the House of Assembly, the Hon. Lorin Lathrop, American Consul and Mrs. Lathrop, Kenneth Solomon, Chairman of the Development Boards, Miss Moseley, Editor of the Nassau Guardian, Mrs. Boyce, wife of the American Vice Consul and Sidney Farrington, Late Royal Air Force, and local agent for the Aeromarine Company.

In a speech after the ceremony, Governor Cordeaux expressed what great pleasure it had given him to accept the invitation of the Aeromarine Airways to perform the naming ceremony of their latest and most-up-to-date aircraft. It was always a pleasure for him to lend his aid to any enterprise which would benefit the Colony. Few among them would have any doubt that the institution of a regular air service between Nassau and Miami would greatly facilitate relations with their friends and neighbors across the Gulf Stream. He would not care to be associated with any enterprise which was not entirely sound and reliable but in this instance he had not the slightest hesitation in accepting the compliment which the Aeromarine Airways had paid him by suggesting that their craft should bear his name.

The 11-passenger Aeromarine-Navy flying boats operated in the Southern Division during the Winter months are overhauled each spring; used in our Northern operations around New York, Atlantic City, Cleveland and Detroit, and then given another overhauling in the Fall and placed in the Florida-West Indies service during the Winter.

On the Great Lakes Division a rigid schedule was maintained, boats arriving and departing on the minute. There were no forced landings and no mishaps during the entire season. Considerable freight was carried, including a Ford automobile (knocked down). This is the first time an automobile has been carried by aircraft.

Contrary to the general impression of the public that Commercial Aviation in Europe has far surpassed American progress, the performance mentioned in the foregoing surpasses European records in the following particulars:

1. Safety of passengers
2. Comfort and convenience of equipment
3. More rigid observance of flying schedule
4. Smaller number of forced landings

Due to the record established for safe operations, insurance underwriters are now insuring our passengers against accident at a very low rate.

An Aeromarine Airport has just been opened at San Juan, Porto Rico, and in January a line will be established between San Juan and Kingston, Jamaica, connecting with Key West and Havana.

It is expected that several new routes will be opened during the new year. Those now under consideration are: New York to Southampton, Newport, Providence and Boston; and on Lake Michigan out of Chicago.

ARMY and NAVY AERONAUTICS

An Aeronautical Museum at McCook Field

Within the course of the next few months there will be opened at McCook Field, Dayton, Ohio, a Museum containing a most unique collection of various types of airplanes and aircraft engines. It will occupy four new buildings at the extreme north end of the field, having a total floor space of 24,600 square feet. The collection of the exhibits was started during the war, and includes airplanes and engines of American, British, French, Italian, and German design. The more successful and widely-known productions of later designs have been added as they were developed, consequently a fairly comprehensive idea of the course of the development of the present-day airplanes and aircraft engines may be gotten by a careful study of the various displays.

The great value of the Museum, however, will be that it will afford a means of obtaining accurate and detailed information concerning the design features of a large number of different types of airplanes and aircraft engines, which is required by those interested in working out new designs. On account of the inaccuracies and omissions of important details, which frequently occur in written descriptions, mistakes in design are often made, or it is found necessary to duplicate costly and tedious experiments. Even if the airplane or engine is available for inspection, it is not possible to determine the details of construction of certain parts such as wing ribs, contours of cams, etc., unless they are completely disassembled, which is impossible in the majority of cases. The method of display used in the Museum will entirely eliminate this difficulty, and therein will lie its great value.

In the engine department, which occupies one entire building, there are displayed 63 different types of engines. Among these are included engines having from 2 to 18 cylinders of both air and water-cooled types. Engines with radial, all-in-a-line V-type, and opposed arrangements of cylinders are represented. The engines of each type are shown. One is completely assembled and mounted on a stand. The other is entirely disassembled, the small parts being placed in cabinets with glass doors, and the larger parts on an open shelf, just under the cabinets. Duplicate parts are stored in closets under the shelf. These parts may be borrowed for use on engines in service at McCook Field by filling out loan cards, which on many occasions will result in a great saving of time and expense. Every part is thus available for inspection and measurement, while the assembled engine furnishes an opportunity for the designer to obtain first-hand information as to their relationship and method of functioning. The cabinets are arranged in six rows across the engine building. Library tables and chairs are placed conveniently near them, and bound

The New Navy airship Type J, built by the Goodyear Tire & Rubber Co. at Akron

documents containing very comprehensive data on all engines exhibited may be obtained from the office in the building.

An aeronautical engineer of wide practical experience will be in charge of the exhibits, and will gladly render every possible assistance to prospective designers and others interested in aviation in securing any available information.

The airplane exhibit includes types of bombardment, training and pursuit airplanes of both foreign and domestic design. These are so arranged that a comparison of the airplanes used by the different countries for the same purpose can be easily made. Certain of the more widely used types of U. S. Army airplanes are completely assembled and fully equipped with navigation instruments, armament, landing lights for night flying, etc. Various special features of the airplanes and their equipment are described on placards. Bound documents are also available containing detailed information relative to their design and performance.

The wings of the disassembled airplanes are mounted in wing racks alongside the fuselage. The fabric is removed from one of them in order to allow an inspection of the spars, ribs, etc. The other wing is left intact to give an idea of the completed part. Various types of landing gears are also shown disassembled, thus making it possible to easily observe the details of their construction.

The Museum can undoubtedly be a great aid to the engineers of the U. S. Army Air Service, and it is hoped that they will avail themselves of its every facility. Manufacturers of airplanes, aeronautical engineers engaged in civil practice, and others interested in the science of aviation will also be welcome, and the resources of the Museum placed at their disposal.

Progress of Lighter-than-Air Training at Scott Field

The course of instruction in airship piloting for student officers and cadets at Scott Field, Belleville, Ill., has been progressing rapidly. The A-4 a one-man control ship, is being used for this purpose. The ship has been kept busy giving one-man flights to those students of the Balloon and Airship School who finished their primary airship ground training at Ross Field last summer. The Pony Blimp has been used for practice flights by qualified airship pilots at the Post.

Airship Hangar at Scott Field Completed

The new airship hangar at Scott Field, Ill., is about ready to be turned over to the Government. The work is entirely completed with the exception of a small block of concrete in front of the south door. The hangar has been used for the past two months for housing the Pony Blimp, the A-4 and Captive Balloons.

The hangar is about the second largest in the United States, costing more than one million two hundred thousand dollars.

Fast Dirigible Put in Commission at Scott Field

The SST-3, or "Mullion", a non-rigid-two-man control airship, which has been set up at Scott Field, Belleville, Ill., under the supervision of Lieut. Frank M. McKee, with Technical Sergeant Olin Brown in charge, has been air tested and found in good condition. This ship is one of the original English bags, and is inflated with hydrogen. It is one of the submarine scout type which was used extensively by the British in 1918 for "spotting" submarines.

The SST-3 is one of the fastest of the Army dirigibles, with a maximum speed of 57.5 miles per hour. It uses two four-blade propellers, driven by two Rolls-Royce "Hawk" type motors, developing 150 horsepower. It is 165 feet long, 49 feet high, 32½ feet wide, and has a gas capacity of 100,000 cubic feet. The useful lift of the ship is 2240 lbs., and its weight is 4,750 lbs. The car is designed for 5 passengers, including the pilots and engineer.

The peculiarities of its construction are the lightness of the bag, which is made of very thin two-ply fabric, and the fact that it has no upper stabilizer.

This type of airship carries 240 gallons of fuel in the four 60-gallon tanks attached to its sides. This amount of fuel is sufficient to keep the ship in the air 12 hours. It has a cruising radius of 690 miles.

The SST-3 will be used for training purposes by the Air Service

© U. S. Navy Photo
New Principles of Construction feature this plane designed and built by C. F. Rocbeville A. C. M. M., (U. S. Navy) in his spare time while on duty at the Naval Air Station at San Diego. A combination of high air speed and low landing speed is accomplished by a "variable camber" wing.

Balloon and Airship School at Scott Field.

Another Non-stop Transcontinental Flight

The "Cloud Duster," a special biplane equipped with a Liberty twelve, and built by Messrs. Davis and Springer in Los Angeles, Calif., is now at March Field, Riverside, Calif., preparing to hop off on a non-stop flight to the Atlantic Coast. The exact date of the attempt is not known, but the local papers report that it will be made during the next full moon. Messrs. Davis and Springer are well-known airplane designers and builders, and we all wish them the greatest success.

Air Service Reserve Officers Purchase Airplanes

Many Reserve aviators, commercial pilots and others are taking advantage of the sale of "Jennys" (JN4D's) at the Rockwell Air Intermediate Depot, Coronado, Calif., and the lower end of the line resembles the test field of a wartime aircraft factory. Flyers from points as far away as Wyoming and Louisiana have bought planes, set them up and started on their homeward journeys. All day long, including Sundays, there are "Jennys" buzzing around on their initial flights and trials, making ready for the "cross-countries" to their future homes.

A Meteorological Station for Scott Field

A new meteorological station is being installed by the Government at Scott Field, Belleville, Ill., at a cost of approximately $3,000, exclusive of the cost of the instruments. This will be one of the most complete of the Air Service meteorological field stations, and will furnish data daily by radio to Selfridge Field, Chanute Field, and to the Weather Bureau at Chicago.

Among the new instruments to be used in this station are the telethermoscope and the Carpenter hythergraph.

Captain Lawrence F. Stone, Post Meteorological Officer, will direct the operation of the new station, with Sgt. W. G. Wills in charge.

Inspector Geo. J. Brands, of the Meteorological Signal Service, is expected to arrive from Washington to inspect the new station as soon as it is completed, which will be about November 25th.

Airship Tows Another One

An interesting experiment was performed recently at Scott Field, Belleville, Ill., with the Airship A-4 and Pony Blimp. The Pony Blimp, with its motor dead, was attached to the A-4 with a 500-ft. ¼-inch rope and was towed by the latter ship for about ten miles. A safe landing was effected with the ships thus attached.

Lighter-than-Air Activities at Langley Field

The Airship C-14 recently made three successful flights, with a total of 3 hours and 50 minutes in the air, after a period of idleness for nearly two months while undergoing repairs. The ship subsequently made another flight of two hours' duration.

A free spherical balloon, piloted by 1st. Lieut. A. J. Etheridge, A. S., left the hangar at 10 a. m. on December 7th. and landed at 2:50 p. m., having traveled approximately 50 miles.

The Military Airship A-6 is being inflated with helium for experimental purposes.

Dayton Chamber of Commerce Honors Major Bane

Members of the Chamber of Commerce of Dayton, Ohio, recently tendered a farewell dinner to Major Thurman H. Bane, Army Air Service, former commanding officer of McCook Field, who was retired from active service.

Addresses were made by Mr. Robert Elder, President of the Chamber of Commerce; Major L. W. McIntosh, Commanding Officer of McCook Field, and Major Bane. Mr. C. F. Kettering acted as toastmaster. Mr. Elder presented Major Bane with a gold watch and chain as a token of the esteem of the people of Dayton.

Among the many guests present were Orville Wright, pioneer aviator, Major A. W. Robins and his staff from Wilbur Wright Field, and department heads of McCook Field, etc.

The principal topic of the evening was the establishment of the new airdrome in Dayton.

New Airplanes for the Chief of the Air Service

Three more special DH4B Messenger Airplanes are nearing completion for the use of General Patrick. These airplanes are all of natural finish, having 135 gallon capacity gasoline tanks which are especially adapted for extended cross-country flights. The first one of this type, which was completed early this fall, was delivered to General Patrick, who was very much pleased with the design and workmanship. He demonstrated his appreciation by having his picture taken with a group of the mechanics who built the ship, using the airplane as a background.

Hydrogen Gas To Be Manufactured at Scott Field

A new hydrogen gas plant is being put up at Scott Field at a total cost of approximately $250,000. The equipment of the plant is being furnished by the Government, and the W. M. Sutherland Construction Company, of St. Louis, has the contract for putting up the buildings.

The plant will consist of two separate gas manufacturing units—one makes gas by the oil cracking process and the other makes gas by the electrolytic process. This plant will make a total production capacity of 6,000 cubic feet of gas per hour.

An Ingenious Device for Testing Engines

A London newspaper tells of a remarkable "Safety First" device now in operation at the Croydon Airdrome—a dynometer plant for testing airplane engines. After approximately every 100 hours of running, engines are taken out, placed in this machine, and submitted to every test and strain which the engines have to undergo in actual flight.

Indicators register minutely the flow of petrol through the carburetors; if they do not synchronize, the fault in the jets or carburetors themselves is searched for and remedied. Thermometers register even the temperature of the lubricating oil entering and issuing from the engine. Finally, the whole engine is dismantled and submitted to a thorough examination for partly worn parts. By this method no fault, however trivial, can escape notice.

The plant, installed by the Daimler Air Service, is claimed to be the only one of the kind used on any air station in the world. It is held responsible for the fact that, since the line opened in May last, only two forced landings have occurred, one of these not having been caused by engine failure.

REVIEW of WORLD AERONAUTICS

The International Air Congress

A strong Executive Committee under the Chairmanship of Major-General Sir F. H. Sykes, G.B.E., K.C.B., C.M.G., M.P., has taken in hand the organization of the International Air Congress which is to be held in London from June 25th to 30th next year. National Committees have been formed in several countries to prepare lists of names for Membership of the Congress, and in other countries lists are being obtained through the Aero Clubs or other representative bodies. Membership is limited to those countries which are members of the Federation Aeronautique Internationale or signatories of the International Air Convention. The subscription is to be £1 (or its equivalent in foreign currencies) for a Member, and 10s. 0d. for an Associate Member who must be a member of the family of a Member. The papers to be read are divided into four Groups, which will hold Sessions simultaneously, and will cover every aspect of the subject from fundamental scientific problems to such matters as passport regulations and the organization of an aerial transport company.

Gibraltar as an Aeronautical Base

The Spanish review Atlas has recently published the outline of a project which has been attributed to the British Air Service. This project contemplates the transformation of Gibraltar in such a way as to make available there the strategical advantages offered by aerial armaments.

The French review L'Aeronautique publishes two drawings which are part of a documentation of this project which has been examined by that review, which however does not stand responsible for the authenticity of such documents.

According to the documents examined by L'Aeronautique, it is contemplated by the British military authorities to establish at Gibraltar an underground aeronautical basis capable of accommodating a considerable number of aircraft and balloons, one dirigible of large dimensions and all repair shops and living quarters for the personnel which shall be needed for the upkeeping of such a large quantity of flying machines.

A number of underground airdromes located at various depths and equipped with electrically operated elevator platforms (some of which as large as 165 feet in diameter) would be used for storing up and bringing up and down the aircraft as it is needed.

Each underground level would have a number of tunnels all leading radially to the plane of the elevator platform—these tunnels to be orientated in the direction of the known periodical winds blowing in that region. Each tunnel would lead at one end to one point or another of the promontory and the outlet of these tunnels would be equipped with a door rotating around an horizontal axis perpendicular to the axis of the tunnel over which the aircraft must pass when getting in or out the tunnel—these doors to open at any desired angle with the axis of the tunnel (this angle to be a function of the speed of the wind and of the speed of the aircraft when either landing or taking off), would act in the same way as a landing platform on an aircraft carrier ship and the same system used on these ships for checking the speed of a landing aircraft would be used in connection with these doors.

These doors would be well camouflaged so as to prevent their being located from the air by an enemy aircraft and furthermore, the outlet of the tunnels would be protected by the anti-aircraft guns of the fortress.

In this project, it is reported that hydroplanes would be brought from the different underground levels to the sea level and vice-versa through a system of locks and canals. Supplies of fuel oil, etc. would be kept up to the storage capacity needed, by submarines and ships.

If we consider that the ground which can be used for the realization of this project is about 3000 feet in diameter and rises above the sea level to a maximum altitude of 1000 feet, the project attributed to the British Government does not seem to be an impossibility, at least as far as space requirements are concerned.

If this project should become a reality Gibraltar would become a most powerful fortress possessing a firing range equal to the flying range of its aircraft and a tremendous help for a naval fleet. In fact, Gibraltar would become an enormous stationary aircraft carrier, defying the torpedoes of all ships and submarines of an enemy fleet.

The Italian Air Routes

Italy is a mountainous country; besides it is very small in size compared with the United States. Rome the capital is right in the center of the territory, which is constituted by a peninsula and two isles.

Night trains leaving Rome at 8 p. m. reach the northern or southern border the next morning. It is very hard therefore, to establish an air transportation service which would compete with the railroad.

However, a definite programme of the Italian Air Routes has been laid, using the same routes which were employed during the war to send the aircrafts from the factories to the front line.

The air routes follow the valleys and the coasts in order to avoid the mountains. They cross the Apennines mountains only in two points.

The total mileage of the air routes will be about 2400 miles, as follows: Nice—Rome—Foggia—Brindisi, 700 miles; Udine—Bologna—Foggia, 500 miles; Turin—Milan—Trieste, 320 miles; Milan—Sarzana, 120 miles; Piacenza—Bologna, 100 miles; Innsbruck—Verona, 150 miles; Campiglia—Cagliari, 300 miles; Naples—Catania, 250 miles.

London-Berlin Aerial Air Line May Suspend

The new commercial air service connecting London, Cologne and Berlin will be suspended soon despite its financial success unless the Air Ministry and the German Government reach an agreement.

A clause in the treaty which gives the Allies unrestricted right to fly over Germany lapses at the end of the year, and Germany has intimated her intention to refuse to allow British commercial airplanes this privilege unless the construction restrictions imposed on her by the treaty are ameliorated.

The Daimler Airway Company thinks it has solved the difficulty by an agreement with German commercial firms which have permission from the Government to operate air liners direct. But the Napier-Instone line via Cologne, which was inaugurated October 1, fears that it is doomed. Air authorities here generally are in favor of Germany having a free field for development because of the vast possibilities for commercial traffic, but they have no hope of altering the treaty.

New Aeroplanes for Siamese Postal Service

The Siamese Government is to purchase nine new aeroplanes to cost about $103,400 at the present rate of exchange for use in the Postal Service, says Consul M. P. Dunlap, in a report to the Department of Commerce. Although authoritative information has been received as to this contemplated purchase no specifications or tenders for bids have as yet been issued. A committee of Siamese aero experts is to decide on the purchase and since these men have been educated in France it was intimated that they would undoubtedly choose French machines. However arrangements are being made through the Siamese Legation in Washington to send students to the United States to receive training in aerial navigation and this will naturally bring Siamese authorities in closer touch with American-made equipment.

Caproni Building New Plane

The Caproni Company of Italy is building another giant flying boat to replace the craft that was last year torn from its moorings during a severe storm and totally wrecked. The ship now under construction is of practically the same dimensions, being 74 feet in length and having a span of 98 feet. It carries 100 passengers and weighs, loaded, 49,200 pounds. Its weight empty runs up to 27,200 pounds. The plane is to be powered with eight Liberty engines, giving it a total of 3200 H. P. To insure safety, the hull is divided into 10 water-tight compartments.

Mail Service by Air From Cairo to Bagdad

The most picturesque of the regularly traveled air routes and the one richest in historical associations is undoubtedly the 864 miles that separate Cairo, the capital of Egypt, from Bagdad, the principal city in Mesopotamia.

In one day the fliers of the British Royal Air Force go from the Land of the Pyramids over the Holy Land and across more than five hundred miles of desert to the Land of the Date. All of these countries were the scenes of early civilizations, and the planes carry the letters of European and American business firms over ruins that are four thousand years old.

The most difficult part of the journey is the 532 miles of desert that stretch between Palestine, or rather Transjordania, and the capital city of the land from which our dates come. There are practically no natural landmarks in all of this distance; it would be comparatively easy, however, to navigate this by compass, but the risk of forced landings can never be eliminated, and the problem was to provide some sure means by which help, if necessary, could be provided for the stranded airman.

This problem was solved by running a number of motor trucks and automobiles over the same track across the desert and marking off a series of possible landing places that will act as a guide to a pilot and enable him to be located by wireless in the event that he has been compelled to come to the ground.

Only this narrow track—two parallel lines five or six feet apart—is the fliers' navigating chart. On favorable ground it is easy to see it even from 8,000 feet aloft but, as may be imagined, it is none too easy to pick up without some indication as to its locality, nor is it a simple matter to follow it when found, if the nature of the ground has prevented vehicles from making more than a slight impression on the surface.

On some places a single track has been reinforced by a number of separate tracks where the cars and trucks spread out instead of following one another, but for the most part the task of the airman is to hold grimly to the single narrow streak. Should he lose sight of it at any time, there is nothing for him to do but to circle around in the air or to retrace his course until the track has been picked up again.

One additional danger the fliers of the Royal Air Force face on this journey—there is always the possibility that some desert dweller who nurses an antipathy to the British may take a shot at a low-flying plane or that the airman, if forced to descend, will encounter hostile tribesmen. However, the nomads of this district have been inclined to friendliness through the action of the Force in picking up and flying to Bagdad with a wounded sheik found in the desert and in procuring for him the medical treatment that saved his life.

But the fliers, when they are prevented from making the trip in a single day and are forced to land in the desert, are still suspicious of the natives. On one occasion a pilot, making a forced landing, was approached by a number of Arabs whose attitude was expectant rather than friendly. The man knew some Arabic and the following conversation took place:

"Are you alone?"

"No."

"How many other airplanes are there?"

"Ten."

"Are they coming here?"

"Yes."

"Have you told Amman (the nearest city) you are here?"

"Yes."

Convinced by these answers the Arabs allowed the engine defect to be remedied and the plane continued on its lonely journey to the date palms of Bagdad. Whether the tribesmen would have adopted a different attitude if they had known the answers to their inquiries were all untruthful is a matter that must remain doubtful. The pilot himself is thoroughly satisfied with the outcome of his adventure and has no desire to pay the nomads another visit to find out the answer.

Air Navigation in Holland

During the summer service the Royal Aerial Company of Holland on the Amsterdam-London and Amsterdam-Brussels routes carried 995 passengers, 803,251 letters, 1,672, 555 parcels, and 62,889 kilos of cargo. In addition, 2,582 passengers were carried on short pleasure trips in Holland.

The service to London is proving a great boom to Dutch flower growers and to the British newspapers. In June and July this year 3,837 kilos of fresh flowers were carried to London and 10,016 kilos of English newspapers to Holland. The total distance flown by the company's machines is now over 1,200,000 k.m., and not a single accident has occurred.

The fares have now been reduced considerably and are only slightly higher than those of the fastest steamship services. The fleet of the company consists of Dutch-built Fokker machines, which have proved reliable and stable.

New Spanish Factory

The Hispano Automobile Co. has erected a special factory at Guadalajara within the past year for the manufacture of airplanes. Planes have been constructed along the lines of certain Handley-Page models, under the supervision of a British advisor, who was recently replaced by aeronautic advisers and technical experts of the Spanish Army. About 60 planes have been built for the Spanish Army up to date and orders on hand call for 30 new ones and 15 replacement planes. These airplanes measure 17 meters from tip to tip (55.7 feet) and use 300 h. p. Hispano-Suiza motors, built in Paris at the factory of that name. Spanish material is being used in nearly all parts of these airplanes, which sell for about 35,000 pesetas.—Commerce Reports.

Production in Finland

The first Finnish airplane factory at Sveaborg has two monoplanes ready for assembly. The wings are placed under the fuselage, giving the pilots a clear upward view, which is considered of great value. The planes are finished with 6-cylinder 300 h. p. Fiat motors, purchased in France, and when completed will weigh little more than 2,000 kilos. The factory has a staff of constructors and draftsmen in addition to 60 professional workmen, and has a capacity of 30 planes per year.

Syrian Air Routes

The Syrie-Liban Aero Club, recently formed with the object of developing aviation in Syria, is to be affiliated to the Aero Club of France, and a certain liveliness in aviation matters may be expected in this country in the near future. The French Air service have already organized 50 landing stages, 10 of them fully equipped as regards shelters, revictualling and repairing arrangements. The principal lines thus prepared are Alexandretta, Aleppo and Deir-ez-Zor on the route to Bagdad; Aleppo, Hama, Homs, Rayak and Damascus, towards Palestine and Egypt; Damascus, Palmyra and Deir-ez-Zor, for the direct crossing of the Syrian desert in four hours; Alexandretta, Latakia and Tripoli for the coastal line.

Elementary Aeronautics and Model Notes

Gliding and Soaring Flight

(Concluded from page 614)

NO limit seems to exist for the variety of sailplanes. The size appears more established. Wing spans of about twenty to thirty feet are frequent. But the seleetion of a wing curve and the shape and disposition of the surfaees leaves one in doubt. Tandem planes, tail-first planes, monoplanes and biplanes have given surprisingly good results. Looking over the field, it would appear that the monoplane is most suitable for sailing flight.

The advantages of the monoplane construction are numerous. First, there is simplieity. This item is of extreme importanee, especially in the experimental stage. Monoplane wings may be built easier and more quiekly, thereby saving mueh time and expense. Aerodynamically the monoplane is more effieient—greater lift is derived from it and lift is one of the prime requisites of the "sailplane". Upward trending air eurrents are utilized by the monoplane wing to best advantage. Of course the best example of monoplane strueture is found in the birds whose example the gliding pilots hope to follow.

Ease of lining-up and taking down are other points in favor of the monoplane. With some of the thiek wing sections being employed it is possible to incorporate some of the body structure at the wingroots, which reduees head resistance and permits a better flow of air at the juncture between wings and body.

At present it is natural that a large per cent of sailplane designs follow the general outlines of powered aeroplanes. A good number, of course, resemble nothing ever eoneeived before, but it is noticeable that the more eonventional types have proven more satisfactory. As the art of sailplane design improves, however, it is likely that forms of structure will depart radically from the powered plane, for the sailplane must fulfill an entirely different set of conditions than that of the aeroplane.

Model Gliding Tests in England

The Society of Model Aeronautical Engineers in London, England, have earried on some unusual eontests whieh should prove of interest to our Ameriean model builders. Competitions are held for "Kite-launched" model gliders. By this system, when the model has reached its greatest height, as limited by the length of the towing line about 150 feet long, the model is automatieally released and a free glide follows. Glides as long as 57 seeonds in duration have been made. On a 100-foot line, one light-weight glider stayed aloft for 25 seconds.

The Enclosed Motor Model

The flying-stiek model driven by rubber strand motive power reaehes its neatest state when the strands are enelosed in the framework. The usual manner to accomplish this is by using a V-shaped stick, a stiek of square seetion, a round or oval section, hollow in every ease and preferably tapered toward the ends.

As distance models have about reached their limit in performanee, the enclosed-motor model furnishes a good basis for new eontests. Not that this type of model is unknown for it has always been a type ehosen by those particularly interested in eonstruetion details. But it is a fact that models with plain ehic framework have always taken the lead so far as records are eoneerned. Still there is the matter of appearanee to be eonsidered, and there is no question about the unsightliness of the rubber strands we use. If it were not for the faet that this rubber-strand motive power is the most effieient souree of power for model aireraft, it would long since have been discarded beeause of its appearance.

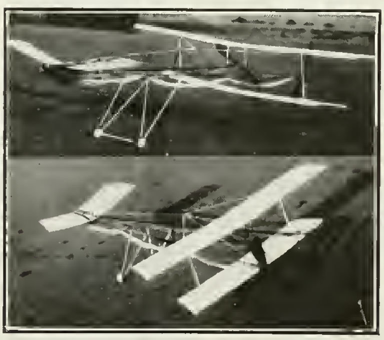
As we must use rubber strands, the best we ean do to "disguise" them is to enclose them in the framework. The result is a model which more nearly approaches the appearance of real full-sized aeroplanes.

The Clark Biplane Racer

By Jack Clark, designer and builder

The Clark twin-pusher biplane was designed primarily for spectaeular flying, with a fair ability for distance. In biplane models there is more resistanee to eontend with but the stability and fine appearance are faetors that make appeal to model builders. This biplane has several unique features as will be noted in the following data:

The frame is eonstructed of spruce main members, tapered from $\frac{1}{4}''$ semi-square in the eenter to $5/32''$ round at the ends. The X braces and rear skid are of split bamboo. The Landing gear is formed of piano wire with fiber wheels provided with brass bushings at the hubs.



The Clark Biplane Racer

Wings are of the single-surfaced type, main spars of spruce, leading edges of $3/64''$ by $3/32''$ bamboo. Ribs about $1/16''$ square. Trailing edge of waxed linen thread. Interplane struts are $\frac{1}{8}''$ by $1/16''$ bamboo. All tension and bracing wires are of strong linen thread.

Fiber propellers are used, eaeh driven by 16 strands of $\frac{1}{8}$-inch flat rubber.

General Dimensions:

Length	42. "
Span, upper wing	40. "
Span, lower wing	30. "
Chord, both wings	4.5"
Gap	6.5"
Span, elevator	20. "
Chord, elevator	5. "
Dihedral	10 °
Propeller diameter	10.5"
Total wing area	387 sq. in.
Weight	8 oz.
Loading per sq. ft.	3 oz.
Stagger	1.5"

Three ounees may seem a very light loading but it must be considered that the model is a biplane and consequently the actual lift effieieney of the wings is decreased for the same area as a monoplane, due to resistanee and interference. The gap/chord ratio is rather high—1.44:1 but for a model the increased lift from a high gap/ehord ratio more than compensates for the inereased resistance. The increase of G/CH increases the biplane reduction factor from 0.77 lift of monoplane area with $G/CH = 0.8$, to 0.89 Ky reduction factor with 1.6 G/CH ratio (*N. P. L. for full-sized planes*). Assuming the same rule to hold true for model biplanes the actual loading would be:

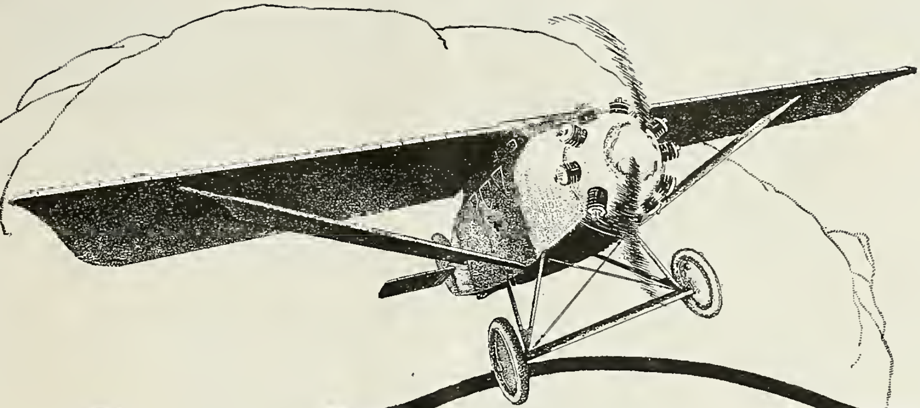
$$L = \frac{W \cdot 144}{A \cdot .87}$$

where L = loading, W = weight of model, 144 = 1 square foot area (represented in square inehes) and 87 = Ky R.F. for G/CH ratio of 1.44, approximately,

$$A = 387,\quad W = 8 \quad \therefore L = \frac{8 \cdot 144}{387 \cdot .87} \text{ or } \frac{1{,}152}{336.69} = 3.42 \text{ oz.}$$

Theoretically, then, the loading is inereased 0.42 oz. by using the same area in biplane form with G/CH ratio of 1.44. But the area of the elevator is 90 sq. in., henee the aetual area affected by biplane form is:

$387 - 90 = 297$ sq. in. $(297 \times .87) + 90 = 338.39$. In other words, 387 sq. inehes of surfaee in monoplane form is equal to 338.4 sq. in. in a biplane with an elevator having 90 sq. in. of surface and in whieh the G/CH ratio is 1.44 in lifting value.



A New Monoplane —The Bellanca C F

One day last June a monoplane was seen hovering over Omaha, Nebraska. It was the Bellanca C F on her first flight. And then—

Four first prizes at the Meet at Monmouth, Illinois—three first prizes at Tarkio, Missouri—first place in all events at Norfolk, Nebraska. This unknown newcomer was unknown no longer.

Today the Bellanca C F is recognized as one of the best designed monoplanes that has been produced.

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constitution and by-laws, has five Governors-at-Large. They are: Governor-General Leonard Wood, U. S. Army at Manila, P. I.; Hon. Newton D. Baker, Ex-Secretary of War, Cleveland; Gould Dietz, Omaha, Nebraska; Hon. Wm. P. MacCracken, Chicago, Ill.; Wm. F. Roberts of the Bethlehem Steel Co., Sparrows Pt. Md.

The following committees also exist under the Association by-laws:—

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Foreign Relations Committee

Frank Dickson, Packard Motor Car Company, Pittsburgh, Pa.

Membership Committee

The Membership Committee is composed of the nine District Vice Presidents, with Mr. Conway W. Cooke of National Headquarters, as Chairman.

In addition to the Committees enumerated above, there are now in formation the following committees: Executive Committee; Finance Committee; Industrial Research on Aeronautics Committee; Scientific Research on Aeronautics Committee; Air-ways and Operations Committee; Junior Activities Committee; and Women's Auxiliary Committee

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In order to co-ordinate the activities of the various committees and to act as Executive Officer at the General Headquarters, under the Resident Vice President, the office of General Manager was created. The incumbent of this office is Lieutenant Colonel Harold E. Hartney.

Lieut. Colonel Harold Evans Hartney, is a graduate of Law of the University of Toronto, and the University of Saskatchewan in 1914, but within a year thereafter he joined the Royal Flying Corps, where he remained for two years. As Captain he received the Italian Silver Medal for Valor, and was transferred in September, 1917, with the rank of Major to the American Air Service. He organized, trained and took to the front, the 27th Aero Squadron. Colonel Hartney was with the 20th British Squadron, and although a double-seater squadron, is credited with more victories than any other Squadron in the British Air Force during the war. Colonel Hartney is officially credited with the destruction of six enemy planes and was in the first air battle of the war, at the first battle of the Somme. On August 21st, 1918, Major Hartney was promoted to Group Commander of the First Pursuit Group and in December, 1918, was transferred to duty at Great Headquarters at Chaumont. In February 1919, he was promoted to the rank of lieutenant-colonel, returned to the United States and became successively Chief of Training, Acting Chief of Operations, and Chief of the Civil Affairs Division in the Office of the Chief of Air Service. Colonel Hartney resigned from the United States Army in October, 1921. In addition to the above decorations, he holds the Distinguished Service Cross, Legion of Honor, and the Croix de Guerre with two palms.

Official; National Aeronautic Association.
By: C. A. Tinker,
Director of Information.

(Concluded from page 62)

or steel. Its disadvantages are that it is the most expensive material, that it will not stand rough usage, and that it will corrode in a salt atmosphere.

Brass has the advantage of not being subject to corrosion in either air or water, but it is the hardest material to work.

Steel is the least expensive material. It is also easier to work and is lighter in weight than brass. Its only disadvantage is its tendency to rust.

Duralumin has the same disadvantages for water piping as have already been mentioned.

Steel is recommended for water piping since this piping is of relatively large size in short lengths, and very little working is required.

Valves and Fittings. Ordinarily only one valve, the drain cock, is used in a water system. A commercial brass cock may be used since the difference in weight due to the use of brass is in this instance practically negligible.

The objection to the use of rubber connections in the form of rubber hose in gasoline lines does not apply in the case of water lines. The greater ease of making connections, the flexibility of the connection, and the saving in weight lead to the recommendation that it be used as standard practice.

A typical water system is shown in Figure 4.

Reserve Cooling System

Piping. The use of aluminum piping is recommended. Ordinarily relatively small piping will be used in the reserve water system which will give aluminum piping the weight advantage. The leads will seldom be short and direct so that not only will the weight advantage of aluminum be magnified, but the greater ease of working will be an additional advantage.

Valves and Fittings and Tanks. Saving in weight causes the recommendation of a combination of aluminum and brass for the valves and fittings, and the use of sheet aluminum for the tank.

Summary

The recommendations of the materials made in this article may be summarized as follows:

SYSTEM	PIPING	VALVES & FITTINGS	TANKS
Fuel	Aluminum	Aluminum and brass comb'd	Aluminum
Oil	Copper	Aluminum and brass comb'd	Aluminum
Water	Steel	Rubber hose connections and Brass drain cock	....
Reserve water	Aluminum	Aluminumandbrass comb'd	Aluminum

(Concluded from page 67)

safety at the altitudes shown in the table. On the other hand, even with exceptional piloting, these altitudes can not be appreciably decreased if a complete 180 degree turn must be made.

There is only one part of the maneuver in which a gain can be made, namely, the take-off itself. The pilot should so "play his field" on the take-off that a complete half turn will not be necessary.

The figures were computed and verified. The minimum altitude lost in the turn, and the best combination of air speed, angle of bank, and radius of turn to give the minimum were computed from the airplane coefficients. Then the altitude lost was measured in actual flight. The table gives only the altitudes which were checked in flight. The agreement between computed and measured values was so close that estimates can be made for other types by means of a chart prepared by the Air Service. There was, however, a discrepancy in the case of the Thomas-Morse, the computed value being almost 19 per cent lower than the measured value.

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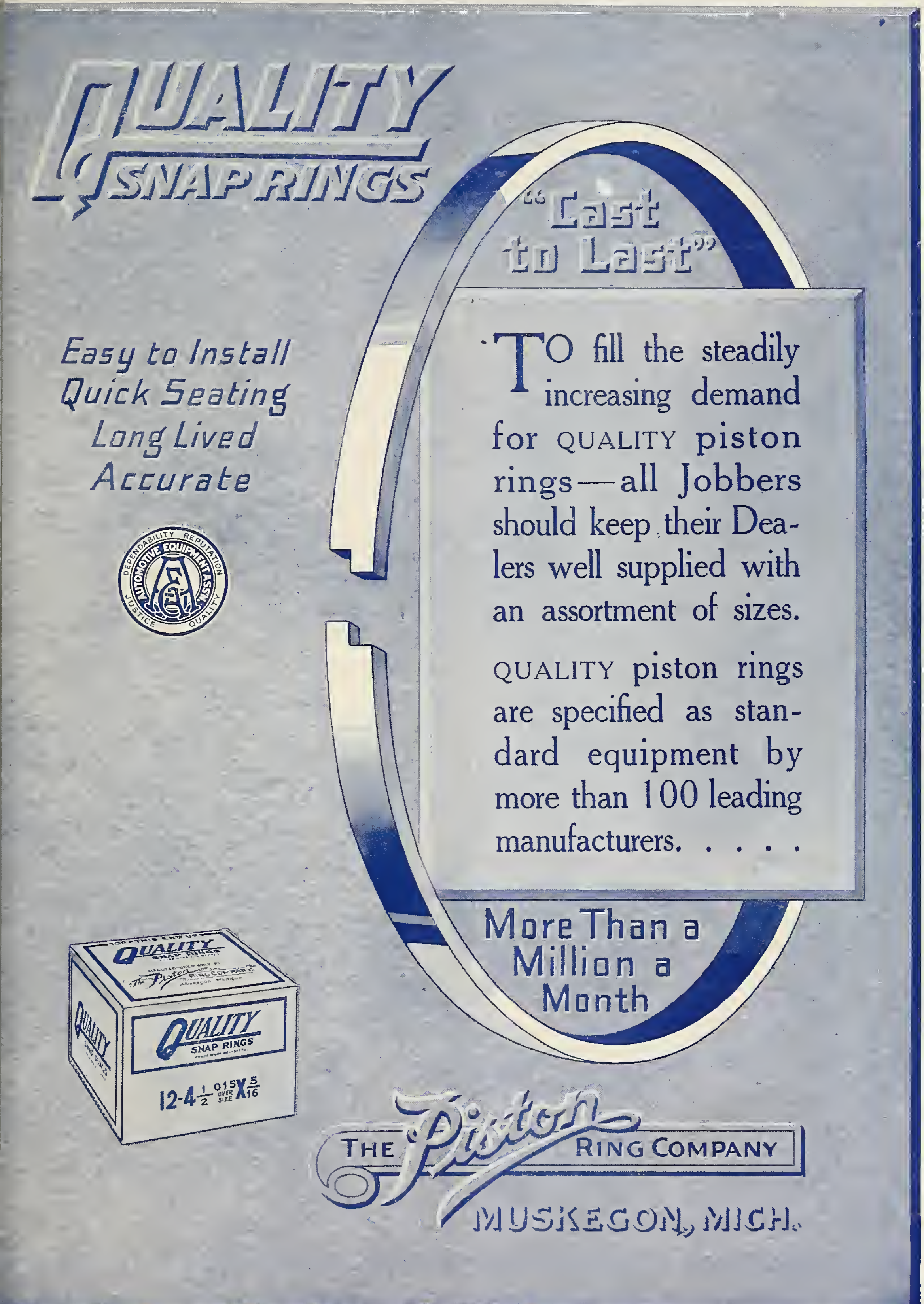

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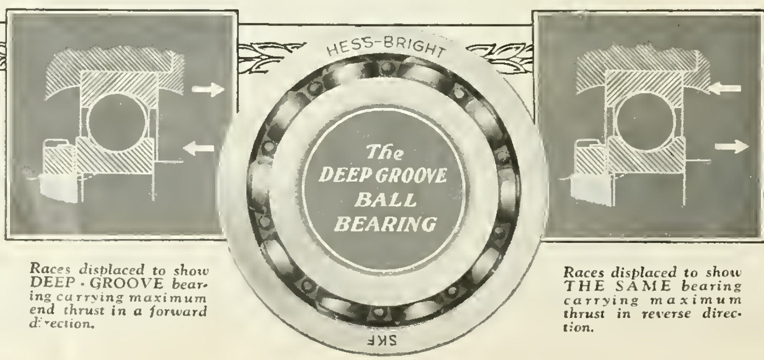
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Aerial view of the Yosemite, where trains and other methods of surface transportation go hundreds of miles around such portions of the natural terrain, while aircraft passes right over it without any hesitancy, making for "bee-line" routes whatever the contour of the earth's surface

Commercial Possibilities of Aviation

By Charles A. Moffett, Vice President and Governor Fourth District, National Aeronautic Association: President of the Gulf States Steel Company

THE commercial possibilities of aviation are illimitable. Passenger and goods carrying by aircraft has potentialities of so wide, so vast development that one might be ranked first among prophets to state even an approximate point where growth would slow up. Here, then, we have a proposition that possesses an elasticity unknown to any existing commercial transport facility. A catalogue of the commercial, industrial and financial interests of the country contains the names of those businesses which can and will benefit as aviation and business come to and take the steps to the fullest cooperation.

From the earliest days of our growth as a nation our chief concern has been transport,—the shortening of routes and gaining of time for goods delivery and individual communication. The United States has by its territorial growth been pushed ever onward in trying to keep up with its transport problems. It has been a fast pace with no breathing spells. Yet, when continental territorial expansion came to an end, transport was still in its infancy. The problems were growing more complex. But we attacked them with vision and broad-gauge principles, and now we know that by our industry, and enterprise, and foresight in unceasingly establishing lines on land and water we have won for our country the business leadership of the world and made this the richest nation ever known.

Without the marvelous development of transportation and communication this result would have simply remained in the realms of the impossible. We would still be in a state comparable with that of our Indian wards, and quite as content as are these wards with the humdrum of the reservation. We are hearing a great deal today about world isolation; in fact the term has become a figure of speech. Well, one can easily imagine that, without concern in transportation, we would have been a sorry figure of speech and of actuality today as a nation. It has made us great and powerful and a world factor that no influence can isolate us; that is, in the commercial sense of the word.

In land and water transportation, however, we are approaching the slowing up point. Here again, the foresight of business saw a new problem arising, and prepared to meet it. The outcome is the vast warehousing systems of the land, reservoirs which would absorb the goods items of transport and prevent the slowing up of our lines and the clogging of their arteries. So much for goods; but warehousing of the individual is impossible, for it is restrictive of liberty of action. It can't be done. And that brings us to the individual possibilities in commercial aviation,—the human factor in which the element of time is most important.

It is not difficult to eliminate this factor. Let us take a few well-known lines as examples. New York to Washington at best is five hours' travel by rail. By air it is being made every day with clock-work reliability in less than two hours and thirty minutes. New York and Chicago are twenty-two hours apart by rail; by air line the distance is negotiated in ten hours. San Francisco is at best four days' distance from the Metropolis by rail flier; by air flier it can be done in twenty-eight hours when a single gap of 900 miles is flown at night. It is now done by Air Mail, covering this gap by express train in 34 hours.

It is ever a race to beat time. We have reached top speed on the surface in the instruments of transport. Only the unrestricted air remains for venturing beyond that surface limit. We have ventured and today there is to America's credit the endurance, speed, and altitude supremacy of the world. This fact shows that the instrument is here for adaptation in the commercial interests,—and as America has demonstrated its superiority in speed and endurance and altitude by test, it remains only to utilize it to the satisfaction, and the profit, of the individual now held in leash by the slower means of transportation. It is being so utilized more and more, and when a goods-carrying service such as the Air Mail, places before us a record of close to 100 per cent operating performance for an entire year,—the question of adaptability is backed by the preponderant weight of reliability. So transportation by air is no longer experimental. It is proved by proof.

Time saving, perfection of performance, reliability and safety, of themselves, however, are elemental. Having these, the next great step is the establishment of stations and terminals; in other words, properly built and fully equipped landing fields. We have made rather wonderful strides in a few years in the establishment of fields in every state in the country; but the development has been more along trunk lines. It is one of the important functions of the National Aeronautic Association to foster, encourage and advance the establishment of flying fields, and it is putting a willing and aggressive shoulder to this wheel and hastening the installation of feeder aerial lines, with the object in view of making it possible for the most isolated hamlet to utilize travel and transport by aircraft. It is a great work and is being done with a spirit and completeness that deserves the most whole-hearted commendation.

All the while, too, the satisfactory air transport performance of today, is the spur to perfection of the morrow. It moves forward as inexorably as time. Thirty-five hours of engine propulsion of an airplane yesterday influences the reasonable attempt at a forty-four hour endurance flight tomorrow. We are going onward in the air, just as we went onward on the surface, but at a much faster pace. Twenty years ago man first went aloft in a power-equipped airplane; two years ago he sailed from England to Australia; three years ago he hopped across the Atlantic in less than twenty-four hours. This year he will encircle the world, or at least develop the reasons why circumnavigation will be a fact next year. One could go on indefinitely in laying before the court of public opinion the evidence of illimitable commercial possibilities in aircraft transportation and communication. But I will rest my case, confident of a favorable verdict.

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Craigie Bridge, across the Charles River, and downtown Boston, the State House and the Custom House being the leading landmarks. Cities in the future must furnish terminal facilities for aircraft, as well as for steamboat and railroad, otherwise they will not garner in the benefits of the most rapid transportation system, aviation

Some Phases of the Army Air Service

By

Major-General Mason M. Patrick

IN REVIEWING the progress and the present condition of aeronautics in general and of the Army Air Service in particular, it seems possible that our citizens may have been lulled into a false sense of security through the favorable publicity given to our aeronautical accomplishments during the past calendar year. Success cannot be permanently attained unless the foundation upon which we build is solid and enduring. This is as applicable to the creation of an Air Service adequate for the protection of our country in an emergency as it is to any other human undertaking. It is true that during the past year an Army airplane piloted by an Army officer reached the highest altitude yet attained; that two Army pilots in an Army airplane made the longest sustained flight ever made in an airplane; that the same officers and the same airplane covered the greatest distance between two points that has ever been covered by an airplane in a non-stop flight; that other Army Air Service officers in Army airplanes broke all existing records for speed around an enclosed course and over a straightaway. The efforts which resulted in these achievements were not undertaken for the mere purpose of breaking records, but were made in the natural course of improving the aircraft in which we have to fly. Technically, however, we may claim to be at least abreast of any other country.

These gratifying performances do not constitute the whole of our accomplishments in the improvement of the types of aircraft with which the service must be equipped. A desirable bombing airplane must be capable of carrying a great weight. We are now assembling an airplane with a wing spread of 126 feet, powered with six Liberty motors of 400 h. p. each, and capable of lifting 20,000 lbs. This airplane can easily carry a five ton bomb in addition to its crew and fuel. A helicopter which seems to possess a high degree of stability has been designed and flown successfully by the Air Service. While this is but a first attempt, and many modifications are necessary, its development appears to hold much of promise for the future. Much, too, has been accomplished in the development of lighter-than-air craft which it is purposed to inflate with helium gas and use for long distance reconnaissance, for the transport of material and personnel and probably for carrying airplanes. Experiments have proceeded far enough to show that it is feasible to attach an airplane to an airship and to detach it at will while both are in flight.

Congress has not been ungenerous in its appropriations to the Army Air Service for the purpose of experimentation with and development of aircraft, and it is believed that the results enumerated above and the accomplishments of preceding years are sufficient to justify the satisfaction our citizens have found in the favorable publicity given to Air Service achievements.

But there is another side to this picture. The greater the development in aircraft, the greater the need for trained personnel to man them. Indeed, when we are dealing with airplanes that rise to heights of more than six miles, and fly and maneuver at speeds in excess of 200 miles an hour, it is understandable that we must train men to endure the physical strains to which they are subjected. Our experience in the late war indicates that personnel to man the aircraft then in use required a period of approximately nine months' training. It is not believed that this period of training can be shortened for personnel to operate aircraft which will be used in the next war. And yet hand in hand with the development of material has come reduction of Air Service personnel.

The present authorized strength of the Army Air Service is only 8764 enlisted men and 1061 officers. After assigning small Air Service components entirely inadequate for their proper defense to the Philippines, Hawaii, and Panama, and to the training centers for peace time training in this country, there remains only sufficient personnel to maintain in the United States at greatly reduced strength, one Pursuit, one Attack and one Bombardment Group, and the Observation Squad-

Major-General Mason M. Patrick

rons in each Corps Area. How greatly the strength of these organizations is reduced below their needs is evidenced by the plight of the Pursuit Group. Approved Tables of Organizations for a Pursuit Group call for 101 officers and 735 men. It has been possible to assign only 15 officers and 600 men to our single Pursuit Group, the only aggregation of fighting planes in the United States for our defense from an air attack.

If a war broke tomorrow, it would be possible to bring this Pursuit Group to an effective strength only by robbing our training centers of personnel whose loss would render it practically impossible to train replacements. War losses will be large, no doubt our Pursuit Group will be depleted rapidly, there will be no properly trained pilots to replace those who fall.

The mission of the Air Service in the next war will, it is believed, be divided into two major parts. On the one hand, it will act as an auxiliary, furnishing ground troops with information obtained by reconnaissance and surveillance and by photographs, and by assisting our Artillery in the adjustment and regulation of its fire. In addition, what may more properly be called the air force may be given missions of its own. This component will consist of Pursuit, Bombardment, and Attack aviation. Such a force should be in readiness to attack the day when war is declared. The use of airplane carriers will permit an enemy to bring air force units to within striking distance of our shores. Proper preparedness demands that we be in a position to oppose such an attack with Pursuit aviation adequate for the destruction of the enemy air force. This would permit our Bombardment aviation to attack and sink enemy airplane carriers and such part of his fleet as may have accompanied them. Our lack of preparedness is evidenced by the condition previously cited of our one and only Pursuit Group.

The condition of our regular Army Air Service would not be so serious if we could count upon the aid of a properly equipped and adequately trained National Guard and Organized Reserve, but a limitation upon the number of National Guard Units that may be organized and the reduction of appropriations for the training of Organized Reserves has accompanied the reductions which the Regular Army has suffered.

So then, while we are justly proud of the technical accomplishments of our personnel assisted by what remains of the aircraft industry, we should face the fact that our lack of an adequate and properly trained Air Force may place our country at the mercy of any enemy power possessing a real Air Force ready to be launched against us at the very outbreak of hostilities.

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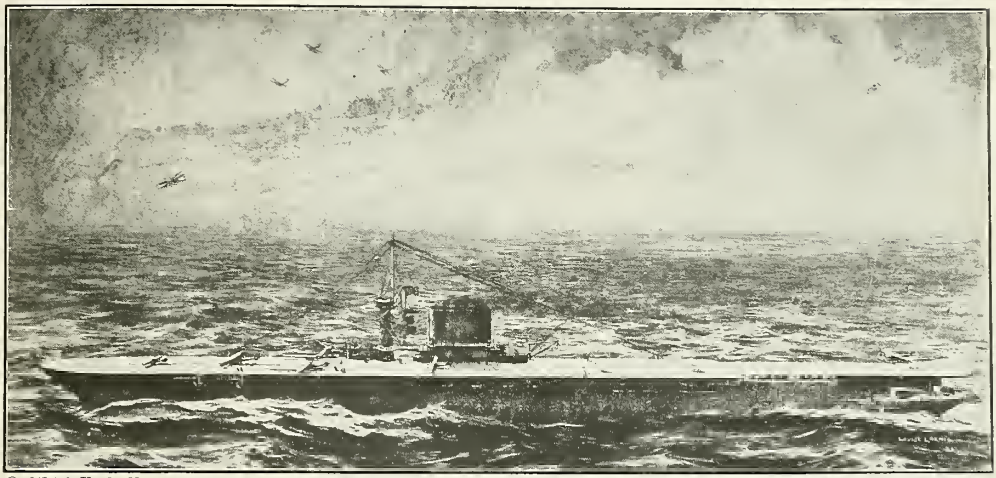
Bunker Hill Monument, Charlestown, Massachusetts. It is interesting to speculate on the conduct of the fighting at Bunker Hill, and the results following, had the Colonists been possessed of one good airplane



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Reproduction of a painting of the new aircraft carriers to be built by remodelling the two battle cruisers, Lexington and Saratoga. These will be the most completely equipped of any ships of their kind in the world

Fleet Aviation

By Edwin Denby, Secretary of the Navy

PERHAPS one of the most significant orders ever issued by a fleet commander is that of Admiral Hilary C. Jones, Commander-in-Chief of the United States Fleet covering aviation classes on board ship. The order reads as follows:—

"The Commander-in-Chief desires that on all vessels of the Fleet to which aircraft or aviation appliances have been assigned, classes, whenever practicable, be conducted in aviation subjects for the benefit of ships, officers.

"Instruction should first cover the general principles governing flight and the fundamental laws of aerodynamics, progressing to descriptions of the various types of aircraft used in the naval service, their potentialties and limitations. When considered desirable by commanding officers, officers desiring to do so may be permitted to make actual flights with qualified naval aviators.

"The purpose of classes as described above is to generally familiarize all officers in the service with the possibilities and limitations of aircraft at present in use, and qualify many to render constructive criticism relating to the application of aviation agencies towards the solution of naval problems."

This order, of course, means, that fleet aviation is certain to have a very important effect in a future naval campaign.

A fleet whose aviation is inferior to that of the enemy will operate under a grave disadvantage, which might well have a decisive influence on the result of the war.

During the World War, the efforts of our Navy were directed toward the building up of coastal aviation. This was due to the peculiar situation when the United States entered the War, that is to say, the German submarine activities were so wide-spread through the British Channel, the Bay of Biscay and the Mediterranean that

Secretary of the Navy Edwin Denby

Courtesy of the Royal Italian Navy

By aerial photography the exact position of guns, ships, docks and defenses of all kinds may be accurately plotted. Here is a photograph of the Austrian ships in the Pola Naval Base on the Dalmatian coast, taken in June 1918, by the Italian Naval Aviation forces in conjunction with the American Naval Aviation forces from Porto Corsini

it was necessary to build up huge coastal stations equipped with aircraft to combat these submarines, an undertaking which was carried out with pronounced success. Further, during the War, because of the fact that the British Fleet had sufficient aviation units, we were not obliged to contribute to that phase of aeronautical warfare.

Since the War, however, we have spent our major effort in placing aviation with the fleet. There has been built up in connection with the United States Fleet several factors which contribute to the developments of aeronautics as a special adjunct to the fleet, comparable to that of submarines, destroyers, and other special craft. What those measures are, form an interesting chapter in the history of the United States Navy.

Immediately following the War, eight battleships were provided with platforms fitted over their turrets from which specially designed planes could fly off. These proved unsatisfactory because they interfered with the operation of the turrets and because the only planes which could fly off the platforms had very inferior characteristics while in the air. Latterly, we have developed a form of catapult placed on the deck of battleships which can be turned in any direction, in the same way that a turret may be moved, and planes projected without interfering with gun-fire or any other routine activity of the ship. This is one of the most important developments of naval aviation in any navy in the world. Our catapults are designed for projecting into the air any type of plane which fits into the tactical and strategical use of aircraft with the fleet.

One of the first duties which will be required of fleet aviation in future wars, will be to carry our reconnaissance over enemy bases. While our fleet is still at a great distance from the enemy, his fleet will probably be assembled at one or more of his naval bases. The Commander-in-Chief must know the distribution of the enemies' forces to conduct the situation. In the Army, airplanes are selected for solving such problems, what could be more natural than for the Navy to use the same instruments?

If the enemy bases were within one or two hundred miles of our coast, our scouting planes could carry out reconnaissance from our land bases. In the World War, our little seaplanes based on Porto Corsini could easily fly across the Adriatic, a distance of sixty miles, and take photographs of the Austrian fleet at Pola. However, these conditions will probably not be repeated in a future war. If we are to reconnoiter enemy naval bases, it must be done by airplanes flown off aircraft carriers. For the carrier to be able to operate close in to an enemy base, it must have high speed to permit it to keep ahead of an enemy battleship or battle cruiser and to dodge torpedoes fired from enemy destroyers and submarines. It must have a large battery of rapid fire guns to keep destroyers and light cruisers at long range. It must have a numerous anti-aircraft battery for keeping bombing planes up to a maximum height.

At the present time our Navy has but one aircraft carrier, the Langley, which is an experimental carrier, being the remodeled collier Jupiter. As a measure of economy in experimenting with carriers to determine the characteristics necessary to permit them to engage in operations such as detailed in the foregoing paragraphs, the Jupiter was selected as the naval vessel which could most readily be built over and which would without great structural changes give maximum deck space

Official U. S. Navy

The battleship Oklahoma puts to sea with a fighting plane on her forward turret. This method of carrying aircraft has given way to the catapult mounted on deck

and storage facilities. Then, too, it was necessary to develop aircraft suitable for taking off and landing on a floating platform, such as a carrier really is. In order to do this economically, the experimental carrier was a necessity.

By knowledge gained from the comparatively inexpensive Langley, we have been able to design an efficient type of carrier, by remodeling two of the giant battle cruisers under construction, which were at first intended to be scrapped under the terms of the treaties resulting from the Washington Conference for the limitation of naval armament. Under these treaties, we were allowed to convert the battle cruisers, Saratoga, building at the New York Shipbuilding Corporation's shipyards at Camden, N. J., and the Lexington, building at the Fore River Shipyards of the Bethlehem Steel Corporation, at Quincy, Mass.

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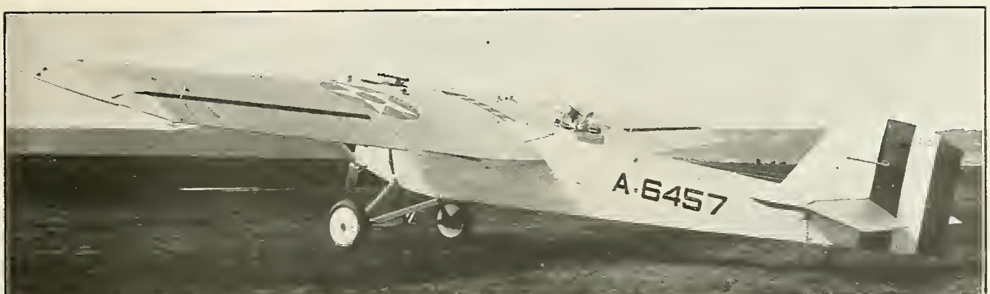
The experimental aircraft carrier Langley successfully points the way for providing the fleet with aviation. She is a floating flying-field, hangar and airdrome

These two ships will be in reality, floating airdromes with enormous decks for taking off and landing, with machine shop facilities for the repair and upkeep of aircraft and storage facilities for them below decks. In other words, these two carriers when placed in commission will be combination hangars, machine shops, and landing fields. They will be 850 feet in length, with a beam of 105 feet, and able to maintain a speed of 33 knots. They will be fitted with powerful turbine generators which will make them unparalleled in the field of marine engineering, for they will have greater horsepower per shaft than has ever been projected in any marine installation, no matter what the type of ship or type of motive power.

Thier speed of 33 knots, which is developed by electrical propulsion, is equivalent to 39 miles an hour on land, the speed of the average express train, and this notwithstanding the fact that the ships weigh 33,000 tons each. The peculiarities of these ships, which make them the foremost of their type ever laid down, are the completeness of radio installation for sending and receiving messages; the elevators for lifting aircraft to and from the decks and the storage space below; the cranes for hoisting outboard and inboard heavy reconnaissance planes; the methods of ventilation and removal of exhaust gases from the smoke stacks, and the maneuverability of such huge ships in a seaway.

Here indeed, is the acme of naval construction and the one great source for supplying the fleet with aviation units for search and reconnaissance scouting, protective scouting, bombing, torpedo attack, gun-fire spotting, and pursuit and protective fighting.

In order that every officer in the Navy may be conversant with the uses of aircraft with the fleet, so that the added air force strength made available by these carriers may find its ultimate use as an adjunct to the fleet, Admiral Jones' order is at once seen to be of the utmost moment to be efficiency of our naval personnel. When our great carriers are ready to take their place with the other navol units, our officer personnel will be ready to accept the responsibilities thereby entailed.



Official photograph, Aircraft Squadron, Battle Fleet.

Martin Ohservation Monoplane now heing tested out by Aircraft Squadron, Naval Air Station, San Diego, Cal.

Speeding the Mails

By Postmaster General Hubert Work

THE advantage of aerial over surface transportation in expediting the mails has been demonstrated beyond all peradventure of a doubt.

With seventy planes now operating in the Air Mail Service by relays across the country between New York and San Francisco, delivery of millions of letters is being hastened that would otherwise be subject to the delays of railroad traffic.

Not only has the performance of aircraft in carrying the mails proven efficient, but it has reached the stage of almost absolute reliability. The missing of a connection at a railway terminal or the failure of a pouch of mail to catch a trans-continental train no longer means that this mail shall be held up for from twelve to fifteen hours awaiting the departure of the next train. Its immediate dispatch over an air mail route assures it such rapid transportation as to overtake a limited train running on a fast schedule at the next stop where it is picked up to continue its journey by rail.

The attainment of the air mail service in 1922 scored 95.52 per cent out of a possible 100. Traveling through rain, fog and snow over high mountain peaks and deep valleys and encountering every variety of air currents, its planes maintained an accurate flying time during 7,999 trips for a distance of 1,756,803 miles. Of these trips, 2,835 were flown in the rain, while the total number of letters transported reached 60,487,880.

But this record approaching perfection was achieved by the daylight operation only and further development of the speeding of the mails by airplane must naturally cease unless the night time is to be utilized. The Post Office Department realizing this situation has already departed from its conservative policy. Preparations for an experimental night-flying service from coast to coast are being made which will undoubtedly be the first regular night aerial system of transportation in the history of the world. It is planned to fly at night a distance of 900 miles between Chicago and Cheyenne, Wyoming, after which the rest of the journey to San Francisco will be conducted in the day time. The schedule is based entirely upon a past performance of pilots of the service, so that letters mailed in New York before 10 o'clock in the morning will be actually delivered in San Francisco before the close of the following business day. This means the transportation of mail from New York to San Francisco in less than thirty hours. As mail carried by the fastest limited transcontinental trains now consumes four days enroute and is not delivered until the fifth day, the advantage of such aerial service over surface transportation is startling in the amount of time saved.

Postmaster General Hubert Work

The money saving side of such expediting of first-class mail will facilitate financial transactions between New York, Chicago and San Francisco and this service will unquestionably prove the means for a wonderful acceleration of financial, industrial and commercial activities.

It is cheering to note the recognition and encouragement of this purpose to operate this night line. We are receiving it from all sections of the country in editorial expressions voicing the best wishes of the people for this new venture and a confidence that the Air Mail record in the future will continue as splendid as that of the past. We cannot possibly ask for more than that, and I have been assured by business men and experts in aeronautics that the experience of the last four years affords them no reason for expecting less.

This is very gratifying, to be sure, but it does not emphasize the actuality, which is, that unless we can make flights at night the Air Mail Service will not have established its substantial value. If night flying can be established, then the service will have definite commercial value; and when that develops it is our present thought that the Post Office Department should let the carrying of the mail by contract by airplanes precisely as it contracts for its transportation by rail now. It is not the intention of the Department to indefinitely continue as an operating agency in the matter of Air Mail. We are, therefore, wholly interested in developing night flying to determine its commercial advantages. And if it proves of commercial use, the carrying of the air mail by private contract can then be effected.

It has been demonstrated that the mail by day airplane, can be carried safely, so that it is not necessary to pursue that experiment further. The question now to be determined is whether the same record can be made

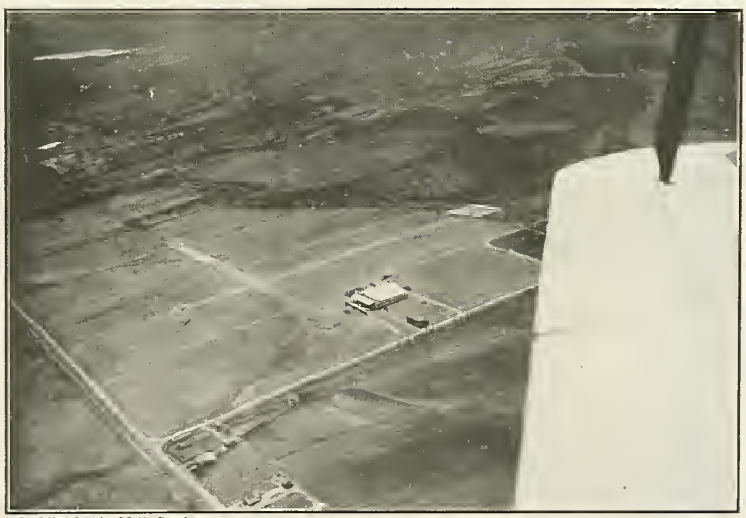
© Official Air Mail Service

Dr. Hubert Work, Postmaster General (at left) receiving from Dr. George W. Lewis, Executive Officer of the National Advisory Committee for Aeronautics, and Chairman of the Collier Trophy Committee of the National Aeronautic Association of U. S. A. (at right), the Robert J. Collier Trophy, awarded to the personnel of the Air Mail Service for the greatest achievement demonstrated in the use of Aviation in 1922. Just back of Dr. Lewis is standing Carl F. Egge, General Superintendent of the Air Mail Service

approximately over the 24-hour period, and our Air Mail Service has been working on that proposition for some four months. This work logically devolves upon the Government, for it is not difficult to realize that if the Post Office Department neglected this new field, its development would be retarded for years because the venture would afford little promise to investors. The important fact that appeals to the most liberal of investors relative to any new enterprise is that of full operation. And as full operation of the Air Mail is still in the future, it is patent that adequate financial backing for a private commercial carrying enterprise would be very timid, if not absolutely apathetic.

The Post Office Department has already established some lighthouse stations to light the field; also pilot lights along the way to define the routes. Emergency fields for landing have also been located. Still to be developed is an instrument that will advise the flier how close he is to the ground at night, and some apparatus must be devised that will assure pilots of their position and safety at all times during the night voyage. These necessary devices are now being worked out and to a large extent the responsibility for it lies with the Second Assistant Postmaster General Paul Henderson, in charge of the Air Mail Service, and Carl F. Egge, General Superintendent of the Air Mail Service. Through their efforts present indications are that these mechanical improvements will be ready when actual service schedules are inaugurated.

In this work the postal service has no competition in the air, but is competing with trains averaging 45 miles an hour. It is already a fact that the airplane has advantages over the train. With night flying the element of competition in expediting the first-class mail matter will be successfully overcome.



© Official Air Mail Service

Air Mail Station at Reno, Nevada

The Practical Importance of the Free Flight Work of the National Advisory Committee for Aeronautics

By Thomas Carroll, Chief Test Pilot, National Advisory Committee for Aeronautics

AT THE laboratory of the National Advisory Committee for Aeronautics at Langley Field, research is being carried on in all of the branches of aeronautics—airplane design and performance, and engine development and improvement. The plant of the laboratory now covers a large plot of ground and occupies seven buildings including a most up-to-date hangar and airplane shop, operating a dozen airplanes of various types. The personnel amounts to about sixty persons.

This work, being done as it is on an Army Post of large dimensions, almost becomes lost among the many and varied activities of the Air Service at Langley Field. But the influence of the work is rapidly being appreciated throughout the world. This statement is meant in its most literal sense, "throughout the world." It has been the pleasure "The thrill that comes once in a lifetime," for many at the Laboratory to see laudatory comment in foreign journals of many tongues and in the aeronautical press of our own country, accompanied more often than not, with excerpts from the reports and notes for which they have been responsible together with the modestly anonymous photographs of apparatus and personnel.

Withal, it is felt that much of the information in the National Advisory Committee for Aeronautics Reports is not hitting the mark in the minds of the big half of the people interested or engaged in aviation, particularly among the all-important class, the pilots.

As a pilot, the writer believes that pilots, as a group, are under educated in the fundamentals of aviation, due perhaps primarily to the puerile, "theory of flight" courses of the war time ground school days. Better this might have been omitted, than that its insufficiency and incompleteness should have shaped its student pilots' minds to channels in which they have become mentally mired. So it is, perhaps, not the fault of the laboratory data per se, nor of the pilots themselves, that the work being done *for pilots* is not of sufficient interest to, or appreciated by them.

While it is evident that all of the work of the laboratory at Langley Field is of importance and interest, it is nevertheless true, that there are certain phases that appeal more strongly to pilots, or other flying folks, who can not assimilate pure theoretical research data.

For instance, while the work of the wind tunnels is necessary to the study of design, in order that improvement may be made economically and expeditiously, still the limitations of the wind tunnels are so generally misunderstood that the solution of their problems has not the appeal that their intrinsic work should accord them.

Likewise with the developments in the engine section, particularly the positive drive, supercharging, and fuel injection problems. These are important and the perfection of either would cause comment universally, not alone in the aero world, but in the whole newspaper reading world. The supercharger will improve the performance of the gasoline engine at higher altitudes where advantage may be taken of high velocity winds, for long cross-country flights, and will give supremacy to our fighting aircraft, should the United States be so unfortunate as to engage in another war of major dimensions. The other is intended to give us an improved internal combustion engine without those parts most prone to failure, electric ignition and automatic carburetion, and in addition will allow the utilization of a fuel oil of low flash point, which will lessen the now much too hazardous fire risk. But in their adolescence, these problems are not interesting to the man-in-the-street; it is in their ultimate consummation that they will receive the appreciation due them.

Chief Test Pilot Carroll in Spad VII

However, the flight work of the aero-dynamic section can not help but hold the interest of everyone who flies or hopes to.

Of these many experiments, the work in pressure distribution is quite rightfully the most interesting in methods, equipment, and results. Perhaps everyone is familiar with the theory of how the contour of the airfoil creates lift, but it has never been exactly known by anyone, just how this lift was distributed. Conjecture and computation had arrived at a generally accepted theoretical distribution, but it remained for the results of this investigation to show directly and conclusively this distribution with exactitude. Hence this data is not alone interesting to those who have wondered at the phenomena of L/D, but of immense value to the constructor of wings, that his loading and its distribution may be a predetermined factor. And in addition to the usual research work in this direction, it was carried further along to speeds of 160 miles per hour, in order that the data would be up with performance progress and not be obsolescent when it is given to the world.

No review of the work of the laboratory, is complete, without mention of the various recording instruments. These instruments, marvelous in their inception, are now, after a long period of use, constant redesign, and refinement, almost human, and much better than human in the infallible certainty of their observation records.

These mechanical observers have been often described in detail in this journal and in others of the technical press, nevertheless, they will bear a short description of their purposes here.

The data which an observer of flight performance gathers during a test flight, comprise the air speed, the rate of climb, the angle of flight path, the rate per mile of the engine, and such matters as can be observed from the navigation instruments. These figures are jotted down hurriedly on his data sheet, stop watch in hand, for the time intervals and the whole is written up on the ground in the office.

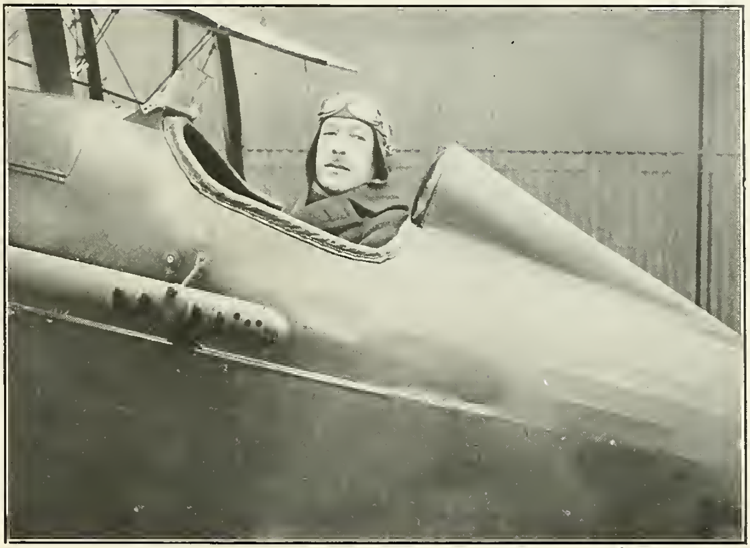
The things of interest which are only manifest through the senses of, and impressions upon the pilot can be obtained in but one way,—so far.

So the observer fills out his report from conversation with the pilot over the cigarettes. "How much rudder does she carry?—Do you have to hold her nose up much in the climb?—Is she heavy on the ailerons?" and the flight chart reads, "The pilot reports reasonably good maneuverability—etc." or sometimes language better in conversation than in print appears "Pilot reports that controls are excessively stiff," or "Difficult to bring out of a dive" or the like.

So this is the part that the National Advisory Committee for Aeronautics recording observation instruments play so well in determining the accurate performance of an airplane—and more particularly in the case of single seaters where, under the old order the pilot tried manfully, and usually unsuccessfully, to write, or remember all the data mentioned above.

So we have our recording instruments—an air speed meter, very sensitive to the smallest variation in speed (the same instrument with but small modifications will show changes in altitude very accurately); a recording electric tachometer of extreme accuracy; an instrument called a kymograph which shows the angle of the flight path with the horizontal; a recorder of the exact position of all of the three controls simultaneously and continuously; and our newest, an instrument which indicates to a finger's pressure the force exerted by the pilot on the handle of the control stick or upon the rudder bar.

Add to all of these our accelerometer, showing the variation in loading on the airplane during maneuvers, and a gyroscopic instrument which gives you the rate of rotation about the various axes during any maneu-



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Assistant Test Pilot King in the SE 5

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The SE 5 fitted with instruments installed for performance tests

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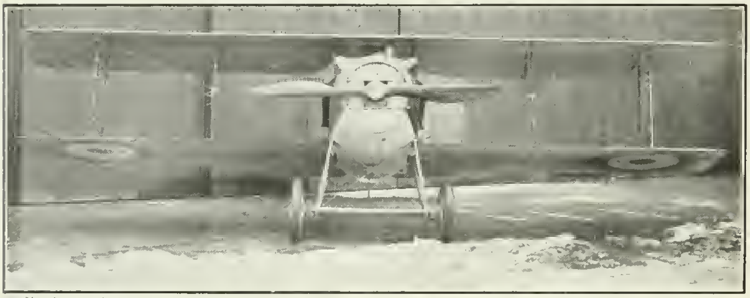
The Fokker D VII, the pursuit type of the German Air Service in 1918



© N. A. C. A.
A front view of the Spad VII showing the excellent streamline form

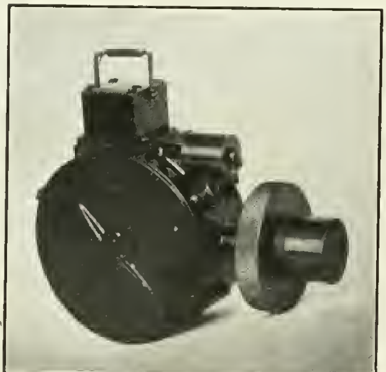
ver or stunt, and you get a sheet of data from a ten minutes' flight that no human observer could record in any number of flights.

It all sounds as though a Handley-Page would be required to carry it all, and a switch board like the control board of a power house to operate them. But that is not the case, they can all be installed in a single seater, a SPAD, S. E. 5, or Thomas-Morse, with less weight than the military load and to operate them we have a single switch or contact button that a pilot can throw on and off without removing his hands from the stick or throttle, if he likes. And neither do they require the slightest attention while flying; they all operate from a common battery and are synchronized automatically.

An investigation, very interesting to pilots, is in preparation at this time at Langley Field. It has to do with the relative abilities of the single seat fighters most commonly considered as the best of the period at the end of the War. They are the SPAD of the French and Americans, the S. E. 5 of the British, and the Fokker DVII of the late German Air Force.

They are representative of distinct types—although contemporary, and to a large extent cover all of the types that are known to this branch of military flying.

The radial or rotary engined airplanes are not considered in this work so far. Radial types are in the ascendancy just now, but it is interesting to note that one of the most potent reasons for the use of engines of this type has been apparently disproven by some of the experiments lately completed in the National Advisory Committee for Aeronautics. Carrying on in the wake of theoretical dogmaticism and in this case perhaps finding the idol with clay feet, it was sought to inquire whether the accepted rule that maneuverability was improved by the bunching of weights near the center of gravity, as in rotary or radial engined jobs, was founded on real fact. The re-



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The kymograph, an instrument which shows the angle of the flight path of the airplane to the horizontal

sults, while not conclusive or universal, owing to the fact that but two types of airplanes were investigated, nevertheless have demonstrated that the addition of considerable weights located far from the center of gravity, thus increasing the longitudinal and lateral moments inertia, had no appreciable effect on the maneuverability.

So that while the advantage of air-cooled engines is obvious, as is their desirability for fighting aircraft, the advisability of placing the cylinders radially in a single plane is obviated, at least so far as aerodynamic reasons are concerned.

In the three types mentioned, the SPAD, the S. E. 5, and the Fokker, to those familiar with them there is little that can be said in praise of the virtues of any of them. They are all good and for different reasons. The SPAD for her ease of control, good speed, diving ability and exceptionally steady gun platform. The S. E. 5 for her inherent stability, making her pleasant on long patrols, smooth maneuverability, good climb, and good vision. The DVII for its combination of all the above. But the SPAD is rather blind and doesn't permit liberties in fast maneuvering, the S. E. 5 is slow and inclined to be "flicky," that is unsteady, in a dive or in some part of a maneuver, spoiling the gunning. But the DVII is slow, too, although it dives well.

Could we combine the speed and rigidity in flight of the SPAD, the visibility and climb of the S. E. 5, the maneuverability of the S. E. 5 or the DVII, together with accessibility for maintenance and repair, we would have a real pursuit ship. Speed, which is to all intents a matter of horsepower, can be increased by the installation of the newer engines of high performance.

It is well enough to say—incorporate these virtues in a new type, but do we know the cause of these effects? With relatively the same engine power, the SPAD is far faster than either of the others, yet the S. E. 5 has less frontal resistance in her struts and R. A. F. wires and the DVII has no wires at all. So the difference must be in the streamlining of the fuselage and in the wing sections. And so it is with the qualities of the others.

Again, controllability and maneuverability, quantitavely, speaikng are never more than the conglomerate

(*Concluded on page* 119)

The French Spad Type VII, the British SE-5 and German Fokker D VI ready for tests for maneuverability and controllability. Pilots Carroll and King in the foreground

Aviation Work of the Bureau of Standards

By Fay C. Brown, Ph. D., Acting Director, Bureau of Standards

SINCE its establishment in 1901, the Bureau of Standards has grown to be one of the largest research and testing laboratories in the country, its work covering all fields of manufacturing industry and all branches of physical science. In addition to its primary function of maintaining the standards of weights and measures, it now maintains many other standards of importance to industry; it recommends standards of practice; it establishes standards of performance; and it solves many technical and scientific problems in its large laboratories employing nearly a thousand men and women.

In addition to aviation problems discussed in the succeeding paragraph, the general work of the Bureau is of value to aviation in many ways. In particular might be mentioned its work in connection with lubricating oils; its storage battery work; its studies of the properties of metals, cloths, and numerous other materials; and its work in photography.

The aviation work is for the most part, undertaken in co-operation with the Army and Navy Air Services, and the National Advisory Committee for Aeronautics. They finance the work and decide on the problems to be solved. They also furnish the practical flying experience, and in a general way, they do the engineering part of the work as distinguished from the scientific. The function of the Bureau of Standards in the solution of the technical problems involved, and the discovery of basic natural laws, and the measurement of data. It supplies the fundamentals on which later development is based.

Aircraft Structure

The ideal in the design of aircraft is to eliminate uncertainties as to the strength of parts, so that each part may be made strong enough for the load it is expected to carry without being made necessarily heavy. This is true of all engineering construction but it is especially true of aircraft, for here, too much weight does not merely increase the cost of construction, it increases the cost of operation as well. In fact, it often pays to go to a great deal of expense in building a machine designed to save weight and thus increase its efficiency.

Tension members can be calculated from the area of the part and the unit strength of the material; but with others, this cannot be done. With struts, beams, wing ribs, and all other parts subject to compression or bending, the proportion and arrangement of the parts makes a relatively greater difference than the strength of the material. In such cases, it is usually necessary to build a full-sized piece and subject it to loads of the same nature as those it will be required to carry, and strong enough to break it. Such tests show how strong the part is, and, by studying the way in which it failed, means can sometimes be found for making it stronger without increasing the weight.

For making such tests, the Bureau of Standards is unusually well equipped. There are testing machines ranging from small ones used to test the lighter parts up to a large one of 1000 tons capacity which will test the largest aircraft parts. One of these is especially designed for the testing of aircraft parts, being built to accommodate very long specimens, yet having a relatively small crushing force. Special equipment has also been made at times when tests were needed that could not be performed on the regular machines.

Numerous tests have been conducted on various types of aircraft parts, such as wooden spars, beams, ribs, etc., samples of laminated and veneer construction, and metal girders. The greater part of this work has been done for the War Department, and the information so gained was used by the officers in awarding contracts for aircraft material.

Several years ago, a lot of duralumin girders for airship construction were tested, and it was found that these girders, as originally designed, had the longitudinal members too light in proportion to the diagonal bracing, and in the next lot, a re-distribution of the weight was recommended. This change in design resulted in a great increase in

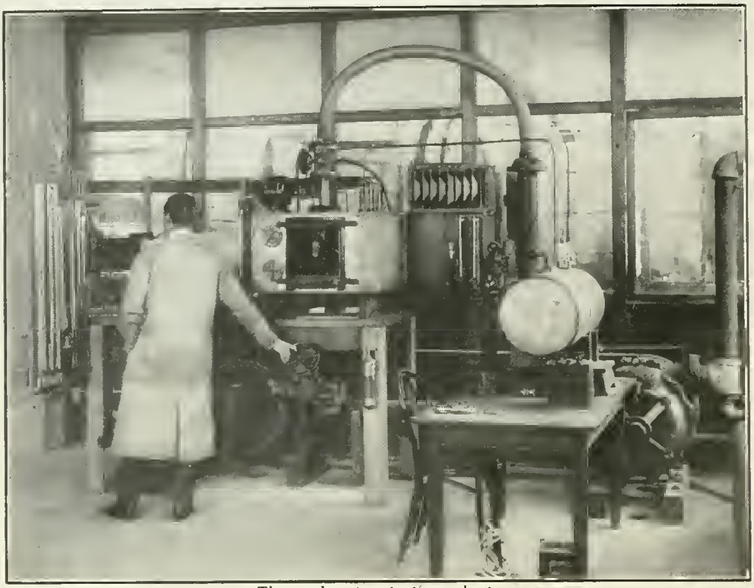
Fay C. Brown, Ph. D., Acting Director Bureau of Standards © Harris Ewing strength without any increase in weight.

Recently another set of girders intended for the airship ZR-I has been tested. The result has shown them to be very good girders, as good, in fact, as could reasonably be expected, and no change in design was necessary.

During the war a design for a metal wing was submitted to the Bureau for test. It was found considerably weaker than a spruce wing of the same weight, but members of the Bureau staff were able to suggest improvements in the design which ultimately resulted in a wing which had the same strength for its weight as a good spruce wing.

A variable camber wing, for increasing the difference between flying and landing speeds, was invented by a member of the staff and was tested in the laboratories. It was shown to be about as strong as the regular type, but has not yet been developed to the point where it is commercially practical.

Of equal importance with lightness and strength is the ability to move through the air with minimum resistance, and the ability of the wings of an airplane to give the maximum possible lift per square foot of area. Tests of these properties are made in wind tunnels where an artificial wind of known velocity is produced and the resistance and lifting power of a part or of a model are measured in suitable balances.



The carburetor testing plant

The Bureau of Standards possesses three of those wind tunnels. There is a four and one-half foot one, giving a wind speed of 90 miles an hour, a high speed tunnel of the same size giving a speed of 180 miles an hour, and a ten foot tunnel giving a speed of 75 miles an hour.

The Bureau of Standards from the air

In these tunnels, tests are now being made of various models for the proposed army semi-rigid airship. These tests will be used in determining the form of the airship, and the size, shape and location of the elevators, rudders, and the stabilizing surfaces.

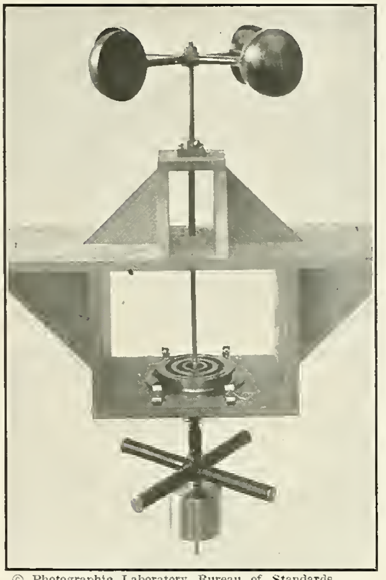
Aircraft Instruments

An important feature of the aircraft work of the Bureau of Standards is the testing and design of aircraft instruments for the Army and Navy. These include tachometers, air and ground speed indicators, altimeters, statoscopes, barographs, compasses, turn indicators, etc. Methods have been developed for testing instruments under conditions approximating those encountered in actual flying. The conditions of heat or cold, low pressure, air speed, and vibration, can be reproduced in the laboratory and their effect upon the performance of the instruments determined. A "dummy observer" has been developed and it is occasionally used for checking the laboratory tests with flight tests.

Several important aircraft instruments have been invented here. One of them is an altimeter of very much greater precision than the usual types. Most altimeters are built like aneroid barometers, with a cell enclosed by two thin metal diaphragms. The space between them is exhausted and sealed and a spring used is to keep them apart. It has been found in practice that the stiffness of these diaphragms causes a "hysteresis" or lag effect which may result in an error of several hundred feet. The new design gets rid of this difficulty by making the spring very stiff relative to the diaphragm. With a well-made spring the lag is greatly reduced, and the instrument is accurate to within ten feet.

An instrument of value to balloonists is a new kind of statoscope. This instrument tells the pilot whether he is rising or falling or on a level. Most instruments used for this purpose are not very reliable and sometimes permit the craft to go some distance and attain a fairly high velocity before they give warning. Then large amounts of ballast or gas may have to be lost in order to stop the motion. The new instrument is much more reliable.

Dr. R. P. Heyl, and Dr. J. L. Briggs, have developed a new type of compass which does away with many of the inherent defects of the ordinary magnetic type without involving the weight and complication



© Photographic Laboratory Bureau of Standards.
The Briggs-Hayl earth inductor compass

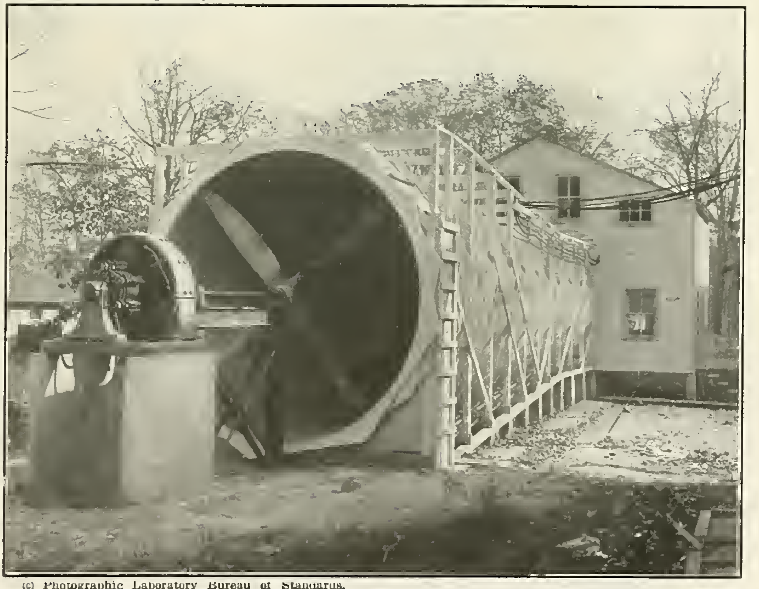
of the gyroscope compass. It is called the "earth inductor compass" and depends upon the fact that the voltage between brushes of a direct current dynamo depends, among other things, upon the angle between the axis of the brushes and the lines of force of the magnetic field. The earth's magnetism furnished the field and the brushes are mounted on the airplane and turn with it. The armature and commutator are driven by a wind wheel and rotate in a plane parallel to the surface of the earth. Two pairs of brushes are used, and they are set at right angles with each other. By means of a set of resistances, the voltages given by these two pairs may be balanced against each other to give a zero resultant. By means of a dial, the resistances are so adjusted that when the airplane is flying along a predetermined course the galvanometer reads zero, but when the machine turns out to right or left the galvanometer is deflected, the direction of its deflection showing which way the machine has turned out.

The dial and its resistances and the galvanometer are placed on the instrument board in front of the pilot. The revolving parts, which are the only parts affected by magnetism, are connected to the dial only by four wires, so they can be placed wherever convenient. In practice, they are placed in the tail of the plane where they are as far as possible from the disturbing magnetic effects of the engine.

A latitude indicator similar in principle to the compass is now being developed; this instrument depending on the inclination or dip of the lines of force.

Power Plants

The performance of an aircraft engine at high altitude is very different from its performance at sea level; and in order that its high altitude performance may be tested in the laboratory, two special altitude chambers have been built. They have reinforced concrete walls sixteen inches thick and are lined with cork insulation. A huge vacuum pump is provided with which the air in the chambers may be exhausted to the low pressure corresponding to the altitude desired. The volume of air



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The largest of the three wind tunnels is built outdoors

exhausted is enormous, the pump being required to handle the entire volume of the engine exhaust. Air for the carburetor is let in through a throttle, and the inlet air and the air in the room can be cooled together or separately to a temperature of 30 degrees below zero. With the engine running, a temperature and pressure corresponding to an altitude of 33,000 feet can be maintained.

All the engine controls are placed outside. Thermocouples are used to measure the temperature of all parts desired and small windows of this glass permit the engine to be watched. The dynamometer which consists of a large dynamo, is placed outside. In these chambers various performance tests have been carried out. Each test includes a series of runs at full power and various speeds, runs with wide open throttles at altitudes up to 25,000 feet, runs corresponding to various propeller loads and altitudes, and runs to measure the friction horsepower, or horsepower required to turn the engine.

In this way tests have been made of various types of engines including Liberty engines, Hispano-Suizas, Packards, and others. Tests of the Packard 1551 to be used in the airship ZR-I have just been completed.

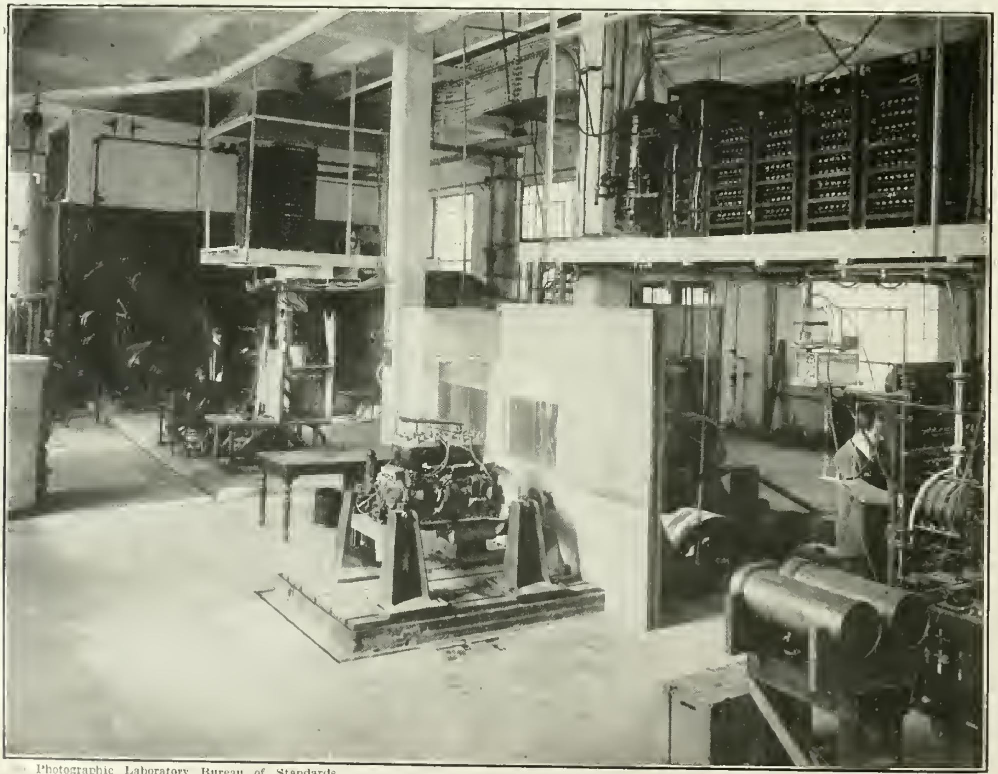
A special type of indicator has been developed for use with high speed engines. It gets rid of the inertia difficulties inherent in indicators of the usual type when used for such work, and it has the additional advantage that when used in the altitude chamber, all the parts that need to be made accessible can be placed outside.

There is a pressure element which screws into the cylinder like a spark plug and consists essentially of a light diaphragm, to one side of which the cylinder pressure is applied while a pressure variable at the will of the observer is applied to the other. As the value of the cylinder pressure passes that of the applied pressure, an electric circuit is opened or closed, making a click in a telephone. A rotating contact is also provided and the connections are such that when the applied pressure is made equal to the pressure existing in the cylinder, at the time this rotating contact closes, the telephone indicates the fact. The card is thus plotted point by point and the indicator requires that successive cycles be uniform for the period of the test.

No entirely satisfactory carburetor for aircraft has yet been devised, most of those now in use having a tendency to give too rich a mixture at high altitudes. Methods of testing carburetors under high altitude conditions have been developed and many carburetors have been so tested. So far, the hand adjusted ones are best in spite of this obvious disadvantage. Automatic altitude compensators similar in principle to aneroid barometers have been tried with satisfactory results. But these are liable to leakage which makes them unworkable when it occurs.

Mr. Sparrow has recently devised a method of control which looks promising, but so far it has not been tested. It depends on the fact that high pressure created by an air pump is proportional to the initial pressure, so that the difference between the two would vary with the initial pressure in an accurately calculable manner.

One of the big problems of the day in connection with aircraft engines is supercharging. This consists essentially in compressing the air from its initial pressure to a somewhere near sea level atmospheric pressure before it is taken into the engine. This prevents the loss of power that usually takes place at high altitudes because of the lessened



Photographic Laboratory Bureau of Standards.

The dynamometer lab. The black wall in the background encloses the high altitudes chambers where the cold and low pressure of 33,000 feet can be reproduced

intake of air per stroke. So far the Bureau of Standards has done little work on this problem, but a series of tests is now being planned to determine the effect on engine performance of various possible methods of superchanging. The altitude chambers will be used in these tests, as it is possible to vary the inlet pressure and temperature, exhaust pressure, and outside pressure and temperature, in any manner desired. The conditions produced by any supercharger can be reproduced without actually building the supercharger; and the supercharger when built can be tested separately.

A one-cylinder Liberty engine is being used for tests on fuels and fuel blends. It is especially useful for studying the effect of different compression ratios, as the ratio can be changed by changing only one piston. Tests have recently been made with it, to study the effects on possible compression ratios of different blends of gasoline with alcohol or benzol. It was found that with benzol or alcohol as fuel a compression ratio of 14 could be used whereas the designed ratio was 5.4. This higher pressure was made possible by the absence of detonation to which gasoline is subject. The tendency to detonate increases with the compression pressure and is decreased by adding benzol or alcohol. The use of a fuel that will not detonate makes possible a higher compression and greater efficiency without increasing the strength of the cylinder.

Radiators

Tests of the cooling efficiency and air resistance of various types of radiators have been made. The latter were made in the wind tunnels in the same manner. The tests of cooling efficiency were made in a special small wind tunnel in which air streams of any desired velocity and temperature could be produced. For the first tests a high altitude tunnel was used in which the air pressure could be reduced the same as in the altitude chambers. It was found however, that the cooling effect was independent of the pressure as such, except insofar as it may effect density, and this method was therefore abandoned in favor of the simpler method of using air at atmospheric pressure.

For a given radiator the cooling effect has been found to be proportional to the mass of air flowing through the radiator whether this mass represents a large volume of air at high altitude and low density, or a smaller volume of air at greater density. Experiments are now under way to determine the relations between this rate of mass flow of the air, and the actual speed of the airplane, the relation varying with the position of the radiator. Of the different types of radiators tests, it was found that, if the flow of air were unobstructed by other parts of the machine, the most efficient type of radiator would be that made of thin hollow flat plate. This type gives the least head resistance and the air flow through it is so much greater than through other types as to more than make up for the greater transmitting efficiency of some of these types. But so far the inherent mechanical difficulties of construction and repair have prevented its extensive use. If, however, the radiator is placed in the nose of the fuselage, as is often the case, a type more similar to the usual automobile radiator may be used to good advantage.

This work has given fundamental data on 125 different types of radiators with air speeds up to 65 miles an hour. It will be adequate for some time to supply the industry with fundamental data which must be correlated with flight performance and mechanical strength.

The Aeronautical Safety Code

Much trouble, inconvenience, and expense has resulted in the automobile industry, because of the short-sighted policy of the early manufacturers and users in combatting regulation of all kinds. To prevent a similar difficulty in regard to aircraft the Bureau of Standards in co-operation with the Society of Automotive Engineers has organized a committee to devise a safety code for the regulation of the industry. This committee contains experts representing the Army and Navy Air Services, the aircraft manufacturers, and all others interested in aircraft.

The aims of the code are as follows:—

1. To establish as technical standards the best modern practice in the design, construction, maintenance, and testing of the aircraft.

2. To standardize the shapes, sizes, markings, etc., of landing fields, and to make the American standard as uniform as possible with those of our neighbors.

3. To serve as a guide to the governmental regulation of the industry by establishing a code of traffic rules, rules for licensing pilots, etc., which will give adequate protection to the flying and non-flying public without unduly hampering the industry.

Some of the features of this code will serve as a guide in formulating the regulations of the Bureau of Civil Aeronautics, and the laws governing aircraft. Other features, especially those provisions dealing with the structure and engines of aircraft, will probably be enforced by mutual agreement among the interests concerned.

The procedure of the American Engineering Standards Committee provides for the periodic revision of the code to keep its provisions in harmony with the progress of the industry.

(Continued from page 114)

opinion of test pilots, are being reduced through the media of recording instruments to definite units of measurement.

By these experiments it is not only confidently expected that a more accurate catalog will be made of the good points of these airplanes, but it is also expected that the "why" of many of these attributes can be definitely pointed out, and that by this chart, we may discover the answer to the question of how to make our pursuit ships better.

It is also proposed to incorporate all of these instruments into a single device which can be quickly and conveniently installed in any airplane for the purpose of obtaining a complete chart of performance data. Can a flyer afford not to take an interest in a combined instrument of this character? not alone from a consideration of the performance characteristics of the airplanes tested, but also to compare the charts of the same airplane flown by different pilots. Certainly the abilities of pilots will be as easy of comparison, through this agency, as are the data in regard to the inherent qualities of the airplane.

And so through the whole program of research experimentation, there are elements of popular interest. Each problem undertaken yields information not only for the aeronautical engineer, but also for the pilot, the observer, and for the man to whom aviation is but a hobby.

What The Weather Bureau Is Doing For Aviation

By Willis Ray Gregg

Meteorologist in charge of Aerological Investigations

Willis Ray Gregg, Meteorologist, in charge of Investigations at the U. S. Weather Bureau, is one of the world's leading authorities on meteorology as applied to aeronautics. Essentially a Scientist, but possessed of an unusually practical mind, Professor Gregg has contributed to the advancement of aeronautics in a marked degree. His research investigations in the upper-air have been one of the factors in aeronautics in America and throughout the world.
Editor

CAPTAINS of ocean-going vessels, before starting out on a long voyage, invariably find out from the nearest Weather Bureau office what kind of weather they are likely to encounter, and, during the voyage are in constant touch, by means of radio, with sources of information as to what changes are in progress or are expected to occur. Shippers of perishable goods,—fruits, vegetables, meats, etc.,—seek the weather forecast and are guided thereby in providing against excessive heat in summer and severe cold in winter. So it is, to a greater or less extent and in increasing measure as means of communication improve, in all the basic industries. Aviation is now passing through what may be called a transition stage, more or less common to every great movement having for its goal the betterment of mankind and the advancement of civilization. It has successfully weathered the experimental stage, characterized by skepticism and discouragement. Presently it will emerge into the full-development stage, functioning efficiently and economically, an agency of great power in human progress. It is well, while we are approaching this latter stage, to examine the various factors that may and should contribute to its success, and it is universally recognized that, in the case of aviation, accurate and timely meteorological information is one of these factors, and a very important one. In fact, such information is *vital,* because, except in the take-off and landing, the air itself, in which all weather changes occur, is the sole medium for the navigation of aircraft.

This being the case, and it will of course always be the case, it seems not inappropriate to outline briefly what the Weather Bureau has done and is now doing for aviation, and to point out lines along which this service should be extended and developed to the end that the greatest possible efficiency may be realized. Such is the two-fold purpose of this article.

Past and Present

In 1870 a weather service was created by Congress as a part of the Signal Corps of the United States Army, and its network of stations soon embraced the entire country. On July 1, 1921, this service was transferred from the War Department to the Department of Agriculture, and its duties and functions were defined as follows:—

> "The Chief of the Weather Bureau, under the direction of the Secretary of Agriculture shall have charge of forecasting the weather; the issue of storm warnings; the display of weather and flood signals for the benefit of agriculture, commerce and navigation;......: and the taking of such meteorological observations as may be necessary to establish and record the climatic conditions of the United States or are essential for the proper execution of the foregoing duties."

This organic Act, under which the Weather Bureau has operated continuously since 1891, provides for meteorological service to meet all possible needs of agriculture, commerce, and navigation; and *aviation is of course, merely the navigation of the air.*

In conformity with the organic Act, above quoted in part, the Weather Bureau has established and now maintains somewhat more than 200 regular meteorological stations, well distributed throughout the country. At these stations, in addition to continuous automatic records of the various elements, twice-daily eye-readings are made of pressure, temperature, humidity, precipitation, state of the weather and wind direction and speed. Similar observations are made at about 30 stations in Canada, and these are made available for use in this country. For forecasting purposes speed in collecting the observational material is a prime requisite and to meet this need the Weather Bureau, in the early days of its existence, devised a system which, with material extensions, is still in use, and which is not approached in efficiency by the meteorological service of any other Government. It would be interesting to describe this system in some detail, but lack of space will not permit more than a brief summary.

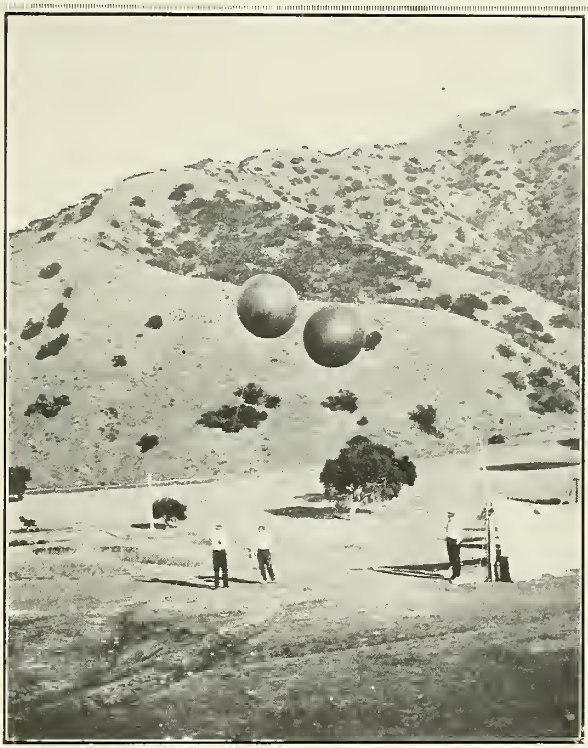
At 8 a. m. and 8 p. m., 75th meridian time, the times of the two daily observations, the Western Union Telegraph Company sets up individual wires called "circuits," connecting a majority of the principal observing stations in the United States, with two contact points in Canada—Toronto and Winnipeg. There are

Willis R. Gregg, U. S. Weather Bureau

23 of these "circuits" averaging about 750 miles in length, the longest being 1340 miles and the shortest 231 miles. From 6 to 12 stations are on a circuit, with a telegraph operator at each point. Several circuits terminate at certain stations to facilitate the transfer of reports from one circuit to another. For example, one circuit extends from Washington to St. Louis connecting 11 stations, including Chicago, St. Louis, Springfield, Indianapolis, Terre Haute, Evansville, Cincinnati, Dayton, Columbus, Pittsburgh and Washington. Promptly at 8 o'clock the Washington observation is sent over the circuit and every operator along the line copies it. This is immediately followed in fixed order by the observations from other stations thereon. Simultaneously the same operation is being followed on other circuits. As soon as the reports of all stations on a circuit are sent, reports collected at the termini are transmitted to other circuits. By this arrangement of collection and transfer all reports are distributed to stations throughout the country by 9 o'clock and sometimes a few minutes earlier. In other words, in about an hour from the time of taking the observations they are received and charted ready for the forecasters.

In addition, numerous reports are received daily by cable and radio from Europe, the Azores, the West Indies, Central America, Mexico, Alaska, the Far East and from ships in the Atlantic and Pacific Oceans and in the Gulf of Mexico. These reports, together with those in the United States and Canada, have vastly extended our meteorological horizon, making possible more or less general predictions of the larger changes in weather as well as the specialized day-to-day forecasts which occupy a conspicuous place in practically every newspaper in the country.

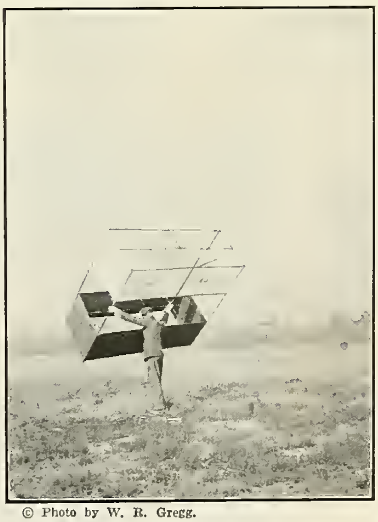
For many years observations of surface conditions only, were taken, and, although much progress was made in the study of the development of different types of weather and in the application of the results of this study to forecasting, yet it was very soon realized that the lack of knowledge as to changes taking place in the atmosphere above the earth's surface constituted a severe handicap. As rapidly, therefore, as funds for the purpose were made available, action was taken to overcome this handicap by the establishment of stations at which free-air observations could be made by means of kites and balloons. Observations along this line were begun by the Weather Bureau



© Photo by W R. Gregg.
Launching sounding balloons at Avalon, Santa Catalina Island, California

about 25 years ago. At first kites only were used.

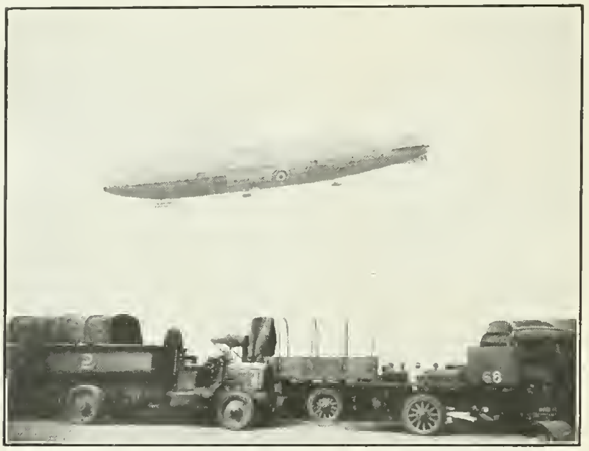
The history of kite flying is very interesting but it is impossible to go into the subject to any great extent here. So far as known, the first kite was flown by a Chinese General, Han Sin, about 2200 years ago. It was for a time used in war, being employed by the inhabitants of a besieged town to communicate with the outside, but



© Photo by W. R. Gregg.
Launching a Weather Bureau kite

later it seemed to degenerate into a mere toy. Twenty centuries later William Wilson at Glasgow University and Benjamin Franklin at Philadelphia first used the kite as a means of upper air exploration. Little more is heard of it until about 1890, since which time rapid strides have been made. The so-called box type of kite is the one in common use at the present time. It is about 7 feet square and about 3 feet high, and is made of spruce framework covered with a good quality of cotton cloth. Kites are attached to piano steel wire of small diameter but high tensile strength, and this wire is paid out from a steel drum which is operated by a variable speed motor, the entire apparatus being housed in a small circular building so mounted on a turntable that it can be easily turned in any direction, according to the wind conditions prevailing at the time. As a rule, several kites are used in tandem in order to lift the wire. The head kite carries a light aluminum instrument, called a meteorograph, by means of which the changes in pressure, temperature, humidity and wind at various heights are continuously and automatically recorded.

For exploring the air to greater heights than can be reached with kites,



British Dirigible R-34 in the daytime. During the flight of this airship from and to England and during 3 days' stay at Mineola, L. I., in July, 1919, the Weather Bureau kept the ship's commander constantly informed as to current and expected meteorological conditions at the surface and at various heights

so-called "sounding" balloons have been used. Made of pure rubber, filled with hydrogen and carrying meteorographs similar to those used in kites, but somewhat lighter, these balloons have given us information of great interest and value to heights of 15 to 20 miles.

Another method of upper air observation, in this case of wind conditions only, consists of sending up very small rubber balloons, usually referred to as "pilot" balloons, and observing them through a theodolite. These balloons are originally from 6 to 9 inches in diameter but are filled with hydrogen until they have a diameter of close to 30 inches. They are then set free and ascend at a rate of 600 to 800 feet per minute. The theodolites through which they are watched consist principally of a telescope and two graduated circles, by means of the readings of which the balloon's horizontal distance from the observation point and its position with reference to a north and south line are accurately determined. With these data at hand, the wind direction and speed at various heights can be quickly computed.

All of the methods, above briefly outlined, have certain limitations. Thus, kites cannot be used in very light winds, nor can the records be computed until the flight is ended. Instruments attached to sounding balloons are not usually found in time to furnish data of current value. Pilot balloons, on the other hand, although not subject to these restrictions, cannot be observed in or above cloud layers. On clear days, though, they can be followed by means of theodolites well above 5 miles, occasionally above ten miles.

Experience has shown that each method has its own particular place and importance. Kite records have enabled us to determine and publish, for heights up to 3 or 4 miles and for all parts of the country east of the Rocky Mountains, the average and extreme conditions of pressure, temperature, humidity, density, and wind, by months, seasons, and the year and for different types of weather at the surface. Special attention has been given to winds, and these have been classified according to surface directions and their characteristics as to change of direction with altitude, increase in velocity with altitude, frequency of different directions and speeds, etc., have been determined and presented in tabular and graphic form.

With sounding balloons this study has been carried to much greater heights, though in less detail, because of the smaller amount of data at those heights.

As a result of these studies the Weather Bureau was able, at the beginning of the War, *i. e.*, the United States' participation in it, to furnish just the kind of information most needed by the War and Navy Departments in connection with the development of aviation and tests on the firing of projectiles. More recently, at the request of the National Advisory Committee for Aeronautics, a report on "Standard Atmosphere," based on all kite and sounding balloon data thus far accumulated, was prepared and published. It contains average values of pressure, temperature, and density for summer, winter, and the year and for all altitudes up to 65,000 feet. These values supply a need that had been long felt in connection with aerodynamic tests, construction of altimeters, etc.

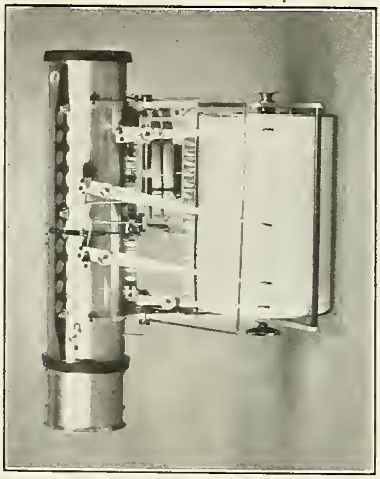
A further study of kite and ballon data has been made during the past two years with a view to perfecting a method of constructing daily upper air pressure maps. The practical application of this study is still in its preliminary phase and little of definite character can as yet be stated with reference to it, but the promise is exceedingly bright. That an intimate relation exists between upper air winds and surfaced weather types is certain. Insofar, therefore, as the upper air maps are reliable, (and they will become increasingly so with added data and study), they will be of definite value not only in forecasting for aviation but also in predicting the direction and speed of movement of storms and therefore in forecasting surface weather.

From the foregoing remarks, it is apparent that the work with kites and sounding balloons is largely of an investigational character, designed to increase our knowledge of the char-

The R-34 at night

acteristics of the atmosphere, of laws governing storm movement, etc., and thus increasing and improving our bases of forecasting. Aviation needs this knowledge and is benefited by it. But aviation needs also, in a very vital sense, information as to what the conditions are now, and that changes are likely to take place in the next few hours. At the present time pilot balloons are the sole means whereby this need for *current* information is supplied. The observations themselves have already been briefly described. It remains to indicate how they are made quickly available for the information of aviators.

The Weather Bureau has now in operation, 6 fully equipped, first class aerological stations, at which both kites and balloons are used, and 9 others where observations with balloons only are made. There are also available for its use, the balloon observations made at about 25 upper air stations that are maintained at flying fields by the War and Navy Departments. These observations are made twice daily and for the most part, are quickly computed, coded and telegraphed to District forecast centers at Washington, D. C., Chicago, Ill., and San Francisco, California, where they are charted, studied in connection with the complete system of surface reports already discussed, and used as a basis for aviation bulletins, issued for the 14 zones into which, for this particular purpose, the United States has been divided. The bulletins indicate briefly current and probable future conditions of cloudiness, visibility, wind direction and speed, and in many cases the best altitudes for flying. They have been furnishing these bulletins by telegraph or telephone twice daily since December 1, 1918, to the Army and Navy Air Services, to the Aerial Mail Service and to others requesting them. In 1921 there was inaugurated, in addition to the telegraphic and telephonic dissemination above indicated, a special service by radio in co-operation with the United States Navy, Twice-daily bulletins, containing surface weather observations from regular stations, upper air observations from aerological stations maintained by the Army, Navy and Weather Bureau, and a summary of weather conditions, forecasts, and warnings, are broadcast from Arlington, Va., Great Lakes Naval Station, and San Francisco Naval Station. Through this medium any flying field and any independent aviator, provided with a receiving set, can thus without appreciable expense or effort, be kept advised as to weather conditions in any part of



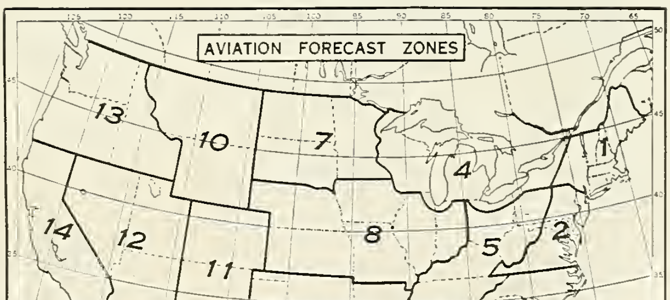
Kite Meteorograph. Records pressure, temperature, humidity and wind speed

the country.

In a report by the Manufacturers Aircraft Association and the Aeronautical Chamber of Commerce to the Secretary of Commerce (see Aircraft Year Book for 1922, page 42), it is stated that "Obtaining information of weather conditions on a cross-country flight ranks in importance with the inspections of the engine and plane, and it is highly desirable that, in peace times, except in emergencies, no cross-country flights should be undertaken until available information of conditions on the way has been obtained." This is merely one among many expressions of a sentiment that is universal. Insofar as its appropriations have permitted, the Weather Bureau has endeavored to supply the needed information in every case. In addition to its daily service, already briefly outlined, it has participated actively in numerous aeronautic undertakings of a special character. Perhaps the most notable instance of this type of service was the trans-Atlantic flight of the NC seaplanes in May, 1919. During the months preceding this event, the Weather Bureau worked in close co-operation with the Navy to determine the best time of year, all factors considered, for the flight, and during the flight itself and for several days just prior to it, thrice-daily forecasts were issued from Washington. In addition a representative from the Weather Bureau and one from the Navy were stationed at Trepassey, Newfoundland, received and charted meteorological reports from American and European stations and from special observation ships at sea and gave information and advice relative to conditions for the longest part of the flight, that from Trepassey to the Azores.

A similarly intensive service was rendered in connection with the trans-Atlantic flight in the British dirigible R-34. It is interesting to note, as indicating the importance attached to meteorological advice by the British authorities, that a trained meteorologist, Lieut. Guy Harris, was one of the airship's crew. During the voyage itself, he received and studied radio weather reports and gave advice to the commander.

U. S. DEPARTMENT OF AGRICULTURE.
WEATHER BUREAU.



Forecasts of weather conditions and of wind at surface and aloft are issued twice daily for the benefit of aviators. They are made at 9:30 a. m. and 9:30 p. m. (75th meridian time), and cover a period of 12 hours, beginning at noon and midnight, respectively.

The forecasts for the various zones are prepared and issued from forecast centers of the Weather Bureau as follows:
Washington, D. C.: Zones 1, 2, 3, 5, 6, 9, and 11.
Chicago, Ill.: Zones 4, 7, 8, and 10.
San Francisco, Calif.: Zones 12, 13, and 14.

(Effective April 15, 1922.)

The new Farman Transport plane with one 600 h.p. motor. The single motored type is rapidly replacing the old twin-motored type in Europe

The French Aero Salon

By Grover Loening, B. S. C., A. M., C. E.

TO many of us who have become accustomed, during the past two or three years, to look upon the French Salon largely as an exhibit of the development of commercial aeroplanes, the Salon this year was something of a shock because of its distinctly military nature. The commercial aeroplanes, particularly of the larger sizes, were in practically every case merely bombers in disguise, and when one finally saw the Farman Goliath in its real colors, equipped as a night bomber, one readily realized that the large subsidies given by the French government for commercial aviation had a very sound and a very practical military basis.

Discussion with some of the more prominent officials soon disclosed that the government, as well as the industry, in France, had a very definite political purpose in making this Salon as much of a demonstration of the greatness of French aviation as possible in order to show the world, at the particular time of the Lausanne and Paris Peace Conferences, that French military aviation was an international force of great power, rapidly taking its place beside the political power of the British Fleet.

The new machines exhibited, the engines, the equipment, etc. were almost entirely military and the imposing array of single seater pursuit planes, two seater reconnaissance planes and torpedo planes gave an unmistakable war aspect to the entire Show.

Another point which shows the confidence of the French constructors in their products is that practically 85% of the machines exhibited have never flown. This was also more or less the case last year, and the interesting point to determine was what percentage of the unflown machines at last year's Salon had flown during the year. It was found on investigation that only 10% were successful. Therefore, much of the beautiful workmanship and many startling disclosures of the Salon must be taken with due reserve because of the lack of proof by actual test.

Outside of the military feature, the most striking tone of the salon was the stupendous effort for metal construction. Curiously one is not impressed by this step as revolutionary, but merely as indicating another way to build an aeroplane if one happens to run short of lumber. The general trend of the better constructors is, of course, towards linen-covered wings over metal frames, as the linen covering furnishes an excellent means of deadening the crystallizing effects of vibration, and incidentally, makes it possible to build a duralumin frame machine for the same weight as wood. But the unfortunate feature of duralumin construction of having to be riveted so much makes the quantity production characteristics of the French type of metal construction almost hopeless. The amount of hand work involved in the elaborate structures displayed would ruin any American factory where labor cost is so high in comparison to the French cost.

In some instances, there is a tendency towards steel, as for instance, in the Schneider, where the spars of the wings are made of steel with numerous steel struts; and other instances where duralumin has given way in the interests of production to the use of steel.

In general, however, this craze for metal appears to be something of a fashion to which the French are as likely to succumb in aeroplanes as they are in women's dresses. Some of the really sound constructors like Farman with long and practical experience still prefer to build of wood and there are many very intelligent French engineers who now admit that instead of abandoning wood so suddenly, there is much to be done in simplifying the type of construction in which wood is used so as to eliminate glued joints, veneer and other flimsy details that represent the real weaknesses of wooden construction.

Among foreign planes exhibited at the Paris Show, were the Handley-Paige torpedo plane, the Savoia flying boat and the Koolhoven two-seater pursuit monoplane. The latter machine in type is distinctly reminiscent of the old Loening M-8 which was built in 1918.

The Handley-Paige torpedo plane is, of course, distinctive due to the weird slot arrangement of the leading edge which certainly slows the machine down to an extraordinary extent, unfortunately not only for landing but also for flying. One is inclined to wonder what vibration effects are going to be found from this arrangement and also to observe that the structural details of the machine itself are not especially rigid.

The Savoia flying boat looks needlessly heavy and does not possess a very comfortable seating arrangement. The finish and details are thoroughly first class. Throughout the Show, there is no question that the most practical looking flying machines are the Farmans. No great effort is made either to be original or to follow the fashions. There is little waste of weight in their construction and their installations are neat and simple. The details appear very easy of production (for example, the square cutting off of the wing tips) and one is reminded of the very competent remark of C. G. Grey, editor of "The Aeroplane", that apparently the uglier an aeroplane looks, the better it flies.

One, therefore, looks forward with interest to the reports of the flying tests, if any, of the new Nieuport Sesquiplane, the DeMonge monoplane, and the Ferbois-Bernard Cantilever metal monoplane, all of which are distinctly works of art as exhibited in the Aero Salon—well streamlined and very graceful looking.

Incidentally, the Nieuport Sesquiplane is completely equipped from a military standpoint and also has the Rateau supercharger installed in a very workmanlike manner.

One was advised, confidentially, that none of the really new and important military features of the French Air Service were disclosed at the Salon, but a subsequent examination of the military planes at various fields and factories showed that the details exhibited in the way of armament, equipment, installation, etc., were all fully up to the latest practice in the French Military Air Service.

Even though there were a great many machines exhibited, one could not help but be impressed with the fact that only a few new trends of construction were being adopted by many people, so that if the exhibit had only been of about five machines, let us say, for example, the Breguet Leviathan, the Nieuport Sesquiplane, the Liore Flying Boat, the Farman Reconnaissance Plane and the little Potez Touring Plane, one would have gathered most of the development of the technical features of French Aviation during the past year or so.

Many of the elaborate body features of very comfortable upholstery

In the foreground, the neat Cams flying boat used by the French Navy for school work, and in the background the Schneider bomber, which is incidentally equipped with the new Lumiere steel propeller and lace curtains applied to commercial aeroplanes are strictly Salon tricks because on the air lines, themselves, all such trappings are quickly disposed of. The popularity of the 150 h.p. Hispano for commercial work is very evident.

Among the technical developments, one was prompted to inquire, and with little degree of success, when a "semi-cantilever" monoplane either becomes a cantilever or does not, and exactly what a "Sesquiplane" really is. From the Nieuport standpoint, it appears to be a perfectly good, rigidly braced strut monoplane, with a trick wing structure housing the landing gear axle.

In the case of the Breguet Type 19 Bis., a quite orthodox biplane (not exhibited at the Salon), with a lower wing of about 20% less area than the top wing, is everywhere advertised as a "Sesquiplane." One might as well call a JN-4 a sesquiplane. In fact, the answer is, of course, the same characteristic above cited of running after fashions. The popular feeling relative to a monoplane induces the constructors to try to disguise their highly successful monoplanes such as the Nieuport by calling them something else. The fact remains that as far as any trend in design is concerned, not only the Salon but the development of new planes throughout Europe, such as the DeWoitine, the Wibault pursuit plane, the new Handley-Paige single seater, the Koolhoven, the Dornier and some new Italian planes—all perfectly good monoplanes—show a very distinct trend in the smaller sizes of machines towards this type.

As a matter of fact, the author has held and continues to maintain that the sharp distinctions between monoplanes and biplanes are entirely unnecessary as the question of the adoption of a monoplane or a biplane for a particular design is entirely a question of balancing various features against each other. In many instances, particularly of larger machines, a proper analysis resulting in the definite conclusion that a biplane is far more practical and in other instances, such as the Loening Air Yacht, the reasons for adopting the monoplane type has much more to do with seaworthiness and visibility than with aerodynamic characteristics.

Many constructors in Europe are coming to this point of view, particularly Fokker, who has now completed machines that can be monoplane or biplane in a few minutes so that the most opinionated of test pilots may be satisfied instantly on the particular whim in this regard. A good monoplane is more difficult to build than a good biplane, simply because more good biplanes have been flown during the past few years and more is known about them.

In conclusion, it is extremely gratifying to note that the display at the Paris Salon, when compared to our developments in this country, does not indicate that we are in any way behind the times in American Aviation. In fact, it is quite the contrary because we are not swayed so easily to extremes and we continue to develop real flying machines that capture world's records instead of the more beautiful "objets-d'art" which so impress the layman at the Aviation Salon.

Incidentally, at a meeting of constructors that was attended, it was made clear that the industry itself, from a business standpoint, could never afford to hold such a Show as this Salon, and that the actual business derived from it was not very great, excepting in perhaps stimulating a few foreign orders which would probably come through anyhow, so that there appears to be at least some argument, if not some question, on the desirability of holding the Salon next year.

The political importance of the display, however, was undoubtedly of great value to the French nation, as they are without question, the greatest military air power by a large margin.

Airscape of Venice, photographed from a dirigible

Reorganization of Aeronautics in Italy

By Lieut. Colonel A. Guidoni, Air Attache, Italian Embassy at Washington

Lieut. Colonel Guidoni has just been appointed by Premier Mussolini, Chief of the Technical Division of the General Bureau of Commercial Aeronautics. His large circle of friends in the United States, and particularly in the air services of the Government, will deeply regret his departure from Washington, while extending sincerest good wishes for success and great achievements in his new post.—Editor.

AFTER some weeks of careful study of the aeronautical situation in Italy, Premier Mussolini on January 24, personally took over control of all the nation's air activities, thus fulfilling the promise of reorganization made prior to forming the new Government. The Premier thereupon created a Commissario di Aeronautics, himself taking charge as Commissioner, and appointing the Hon. Aldo Finzi to the post of Assistant Commissioner. The latter is the executive head of the coordinated and correlated aerial establishments of the Government and is under direct authority of the Premier, who as Commissioner will, of necessity, be unable to devote much time to aeronautics.

The outstanding characteristics of the new organization are that the Commission is wholly independent of the Army and Navy Departments and that it will control both military and commercial aviation. In other words, the plan of organization gives Italy a separate air service. The War Department had endeavored to retain control in a Bureau of Aeronautics operating under the Assistant Secretary of War, but this plan was eventually abandoned in working out the new scheme of combining all air activities under a single responsible head.

In effect, aeronautics in Italy is now an independent department and will have the same administrative and political standing as have other departments. The Commissioner or his Assistant will also participate in the meetings of the Cabinet.

Assistant Commissioner Finzi is an aviator who had much experience in the service with the Army during the World War. He was attached to the Air Squadron commanded by Gabriel D'Annunzio and took part in the great raid over Vienna. All aeronautical bodies in Italy are looking to him with confidence in his ability and purpose to foster, encourage and advance the air interests of his country.

Colonel Moizo, who was a member of the Italian delegation at the conference of armaments in Washington, will be chief of the General Military Bureau in the new Department. Commendator Mercanti has been appointed chief of the General Commercial Bureau.

Among the initial functions of the General Military Bureau will probably be the conduct of an exhaustive study of plans for an air force, which will embrace the organization, instruction and government of all tactical units which are operated by the Army and Navy. The General Bureau of Commercial Aeronautics will have a division that will handle the establishment of air routes, licensing of pilots, granting of airworthy certificates for aircraft, etc., and a technical division which will be in charge of all research, experiment, production work and material supply to all branches of the Army, Navy, and separate air services. This technical division consequently will be of great importance in the department.

The new plan thus presents the following graphic outline of organization:

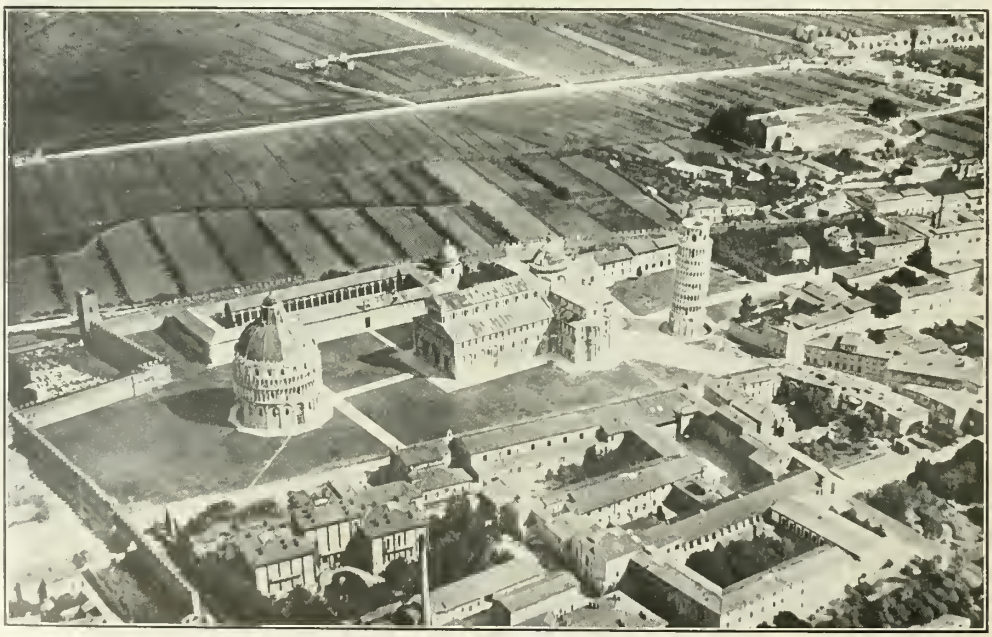
- Commissioner of Aeronautics
  - Assistant Commissioner of Aeronautics
    - General Bureau of Military Aeronautics
      - Air Force
      - Army Units
      - Navy Units
    - General Bureau of Commercial Aeronautics
      - Technical Division
      - Commercial Division

Lieut. Colonel A. Guidoni

Airscape of Vienna under propaganda bombardment by the Italian air forces

According to recent information, appropriations for aeronautics in Italy amounting to 27,000,000 lire ($13,000,000) have been granted for the next fiscal year. The program provides for the building of 720 aircraft of all types.

Italy has more and more concentrated upon the development of commercial aviation. To this end it is recognized that the essentials of such a purpose are (1) to develop and maintain a sound aeronautical industry; (2) to develop and maintain a reserve of personnel; (3) to develop such transportation services which will integrate the European international air trade, taking advantage of the fact that Italy in this transportation development is the natural bridge of the Mediterranean Sea.



Airscape of Pisa

Helium in the National Defense

By John E. Raker, Representative in Congress from California

Hon. John E. Raker, Representative in Congress of the Second District of California, has represented that District since the 62nd Congress and was reelected for the 68th Congress. He is a member of the following important committees: Immigration and Naturalization Committee; Woman Suffrage Committee; Irrigation of Arid Lands, and Public Lands Committees. Mr. Raker has been active in behalf of constructive legislature dealing with Aviation as it affects the United States.—Editor.

IN THE House Committee on Public Lands, which is generally engaged with legislative matters related to homesteads and preemptions connected with the public domain, we have just completed the hearings on the bill authorizing the conservation, production and exploiting of helium gas. Now, the situation of the Committee with reference to expert knowledge of this mineral resource which is bound to be a most important factor in the development of commercial aeronautics and in the aerial defenses of the nation, was somewhat analogous to that of the general public, although the members of the Committees had, of course, a closer contact with the operation and navigation of airships because of such navigation and operation in the vicinity of Washington. But as to the lifting power of such ships and the distinction between gases, information has been rather meagre.

We have heard of helium gas in rather a general way and usually when an accident has happened to an airship using hydrogen, when it has been emphasized that the resultant fire, as in the case of the semi-rigid Army airship Roma, would not have occurred had helium been employed as the lifting element in the ship. And we have been expertly informed that the United States has practically a monopoly of helium; that under adequate provisions the extraction of helium from natural gas will be done at a reduced cost comparable with the cost today of hydrogen and the wastage of hydrogen in use.

When the Committee on Public Lands, therefore, made inquiry into the purpose of the Bill H. R. 11549 introduced by Chairman Kahn of the Military Affairs Committee, and its effect upon the conservation, production and exploitation of helium, the question uppermost in the minds of the members was: "Why has not this great safety element in the operation of airships been adopted for the welfare of the Government and the progress of aerial travel?" Well, we have had our hearings, and the conclusion seems to be that the Government is no less conservative than the people. Helium is something new, just as were sprinkler systems for fire control in buildings. And we can get an estimate of the attitude toward helium from our personal knowledge of many persons who still disregard and resist insurance against fire. If there were not millions of persons of this attitude, our fire insurance companies might save vast sums of money now spent for advertising and solicitation. There you have it: Lack of knowledge as to helium and its uses in airships, and apathy toward the question of the advancement and the conservation not only of this mineral element, but life itself.

I take the attitude, and I believe it to be dictated by right and by common sense, that the United States Government has neither the right nor the privilege of resisting insurance against loss, either to the Government or to the people. That is the plain case as between helium and hydrogen as the lifting element for our American airships.

There is another consideration that makes for apathy as to development of American supremacy in the air, and that is the very newness of the art of airship communication despite the war stories of the remarkable accomplishments of the Zeppelins. It is new to the United States so far as being a common carrier of the air. But if the great airship the Navy is building at Lakehurst, N. J., filled with helium and operated and navigated as the first of our important air cruisers proves a success,—

Hon. John E. Raker

as I am convinced it will prove,—then every American capable of reading his daily newspaper will soon be in possession of the convincing information that the day of absolutely safe aerial travel is at hand. And his interest and trust in airships will thereafter be unshakable.

And that gets us back to the production of helium even if solely for the national defense, were its utility for public convenience (and eventual necessity) thrust aside. We are doing little as a Government in the production of helium for the meagre appropriations preclude the extension of the existing extraction plants and absolutely shut the door to the conservation of the natural resources which must be controlled for the adequate production of helium. The while we are building the airship for the Navy which will require almost all the helium yet stored up,—about 2,250,000 cubic feet,—the so-called Zeppelin reparations airship, which is building in Germany for the United States, is nearing completion and must be flown across the Atlantic filled with hydrogen gas.

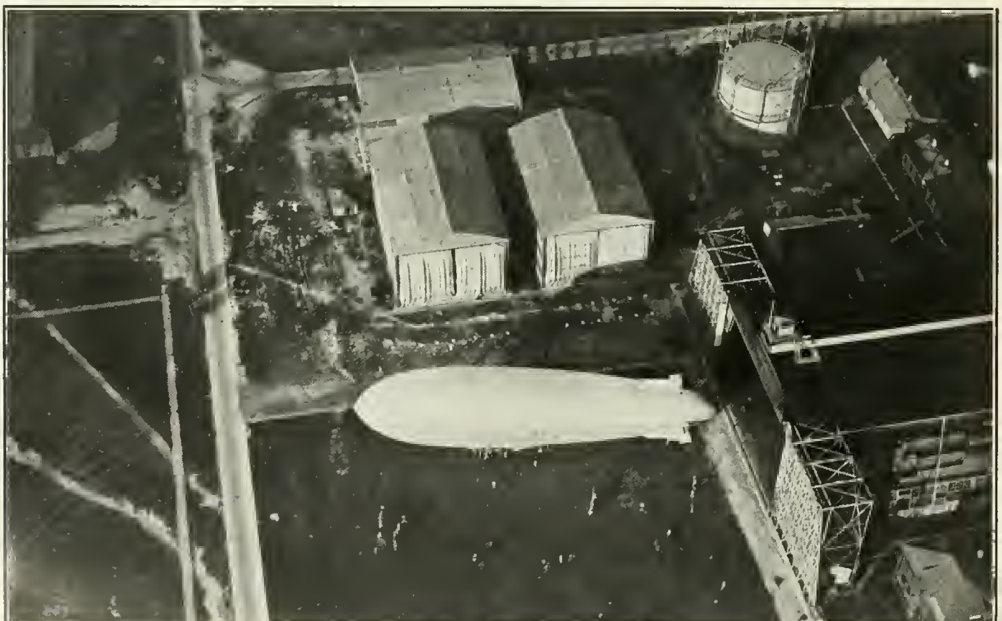
These facts explain more readily than pages of argument the existing condition as between safe helium and unsafe hydrogen. We will have just enough for one ship here, and none for the ship destined to make an oversea cruise of 3,500 miles with its precious complement of United States Navy officers and men. We know what happened to the ZR-2 in England, and in the light of that irreparable catastrophe we have rested content and indifferent to the common-sense demand for the production of helium.

We ought to waste no more time in protecting the Government as well as the individual. We cannot afford to take the chance with the officers and men of our Services who are of necessity the pioneers in this one phase of aerial communication, for we owe it to these brave men to give them every safety element possible in the prosecution of the work of development of air power for the United States.

It is a purely business proposition, this adequate development of the production of helium, just as is the installation in all our modern business buildings and factories of sprinkler systems and fire plugs and fire drills. We have terrible examples before us,— complete loss of men and ships in the Roma and ZR-2 disasters,—and these alone should cry out to us to do our part to make such disasters impossible. And we can do just that in the adequate production of helium gas and the conservation of those natural gas fields which are the source of this wonderful and safe element.

Granted helium airships, operating with the Army on land and with the Navy on sea, we shall have a distinct defensive advantage for the nation, and a guarantee of security for our valued and extensive coast line. Every consideration from the point of view of the national defense and from the fundamental basis of safety not only for our airship operations but the people, converges upon the sound exploitation of helium gas and to the utmost extent of our facilities for production. For helium can be stored and used as required, and it should be so stored against eventuality just as we store any other essential instruments of national defense.

In conclusion, let me state it plainly: On the basis of the airships now in use in the Army and Navy there is a 2,100 per cent loss in the use of hydrogen. That is, the hydrogen must be thrown away after a certain length of use because it becomes a perfect explosive mixture of great hazard. With helium the loss is fifty per cent per annum. There is no room for argument.



© Navy Official Photograph

The C-7, the Navy's non-rigid airship, the first in history to be inflated with helium, starting from the Naval Air Station at Hampton Roads, Virginia, on the memorable flight to Washington, D. C. on December 5, 1921

Homogeneous Air Organization

By B. H. Mulvihill

Vice-President of National Aeronautical Association of U. S. A.

THE advantages that are to be derived from uniformity of methods are known all the way along the business line from the one-man shop to the greatest corporation. It is obvious, in scanning the commercial and industrial history of the United States, that the marvelous progress of the nation's business has been due more to the aptness of the American to grasp the advantages of ever-advancing methods, unhampered by restrictions and with a freedom limited only by capability, than to any other influence.

From the early Colonial days our men of business have characteristically faced fact and given it battle. From time to time their struggles were involved because of the complexity of conflicting national interests and desires, as in the Civil War. But, whatever for any period obstructed the freedom of business development, it was only temporary and when removed was followed by a development greater than could have been foreseen when the check to progress was imposed.

There is no need of cataloguing the never halting steps in American business progress through adaptation of tried and uniform methods. We are still primarily concerned, moreover, with progress in transportation and communication in a land so extensive as the United States, for it was the ever-advancing line of communication by railroad and by steamboat which carried the nation, like a Colossus to the goal it has attained in land and sea transport.

We have, after experience in trial and failure, come to the point where there must be departure from the haphazard in the science of air transport, the point which indicates conclusively that the important step is toward homogeneity of aeronautical organization. That step has been taken in the institution of the National Aeronautic Association of the United States of America and, we believe, we are for this reason at the threshold of the greatest advance in air transport, in this twentieth year since man first navigated the air in a power-propelled machine.

The development of transportation has always leaned heavily upon the government, as was the case with our railroads. It has been the same with aeronautics; perhaps it should be said that aeronautics has leaned almost wholly upon the government since the first Wright airplane was purchased for the Army Signal Corps. Today the air auxiliary in the Army and Navy and in the Post Office Department is, in effect, a subsidy to warrant air advancement. Confined and constricted by governmental patronage, and for purposes which are far removed from the commercial utility of this new instrument of transportation, aeronautical development for the benefit of all the people has simply not functioned.

The progress in the air in America has been marvelous, to be sure; but for so favored a land aviation is still in its infancy as a public convenience,—and conveyance. It is to bridge the gap between the wholly inadequate promotion of Government services with meagre government funds and the tremendous potentialities of air transport that the National Aeronautic Association has been founded. Its organized purpose is to command recognition from the business interests of the country for the advantages which will accrue from uniformity in method, in control, in equipment, in all the advantages that have marked the path that has been blazed by American pioneering in the air. The foundation has been laid by the work in aviation under government patronage, and it is a marvelous foundation. It rests now with the National Aeronautic Association to step out from this mark and impel toward an early realization of the business possibilities,—in commerce, in industry and in finance,—of aircraft performance.

The government in the three executive departments utilizing air equipment has gone far; but it could not go to the length and breadth of the country, for example, in the important essential of establishing air terminals and stations. Some work along this line has been done under the spur of needs for the national defense, but landing

Bernard H. Mulvihill, First Vice-President National Aeronautic Association fields that rarely are used because of the rarity of government fliers, soon fall into disuse and are a waste of the money spent in installing them.

In this one direction the plan and purpose of the National Aeronautic Association attain an importance that is incalculable, for until the field facilities are at hand the network of air lines is an impossibility. Here is a real ground-work in a double sense. It must be done expeditiously as well as expertly, else there will be nothing in the work either for aeronautics or for the business man. And herein uniformity of method will supply the advantage the operator of the transport in the air must have to make certain the success of the whole scheme of air transportation.

If there is lacking control, backed by Federal authority, as provided in the Wadsworth bill which places control in a Bureau of Aeronautics in the Department of Commerce, commercial air transport cannot depart from its present state of instability. That is not said in a spirit of criticism, for we have only to recall the pre-control days of land and water transportation with its cut-throat competitive scrambles for business that became a scandal.

If equipment and its inspection are to go on in happy-go-lucky, hit-or-miss fashion, even a President of the United States will be outraged not once, as recently instanced, but many times, for Washington is evidently destined to be the goal of both the so-called gypsy of the air, as it is the Mecca of all good Americans. If the contests which are the beacons of American enthusiasm and invention were to run wild; well, the sport would soon degenerate into the category of orgies.

© General Photographic Service

Katharine Wright christens the flying boat "Wilbur Wright". Left to right are:— Percy MacKaye, poet and playwright, Vilhjalmur Stefansson, Arctic explorer, Orville Wright and Miss Katharine Wright

So, there has been a real need for an organization upon broad-gauge national lines, affiliated with forward-looking aeronautical organizations in all lands and particularly in the extensive field of air progress in Europe, that would hold aeronautics true to the line along which lies the widest and most practicable achievements.

The groping stage has been passed; the way out to national supremacy in the air, in every direction possible of development, is through the wide open door of the National Aeronautic Association. The way in is as open and by the enrollment of thousands of Americans who are keenly alive to the possibilities of air transportation and to the logic and right of sound air policies, and who have the vision to see that by development of these possibilities America will not only gain air supremacy but retain its commercial supremacy, the work is going on at a pace which even the most sanguine of its projectors dared not hope for. The bridge between the government on the one side and the manufacturer and operator on the other side has been stoutly constructed to bear the traffic of our common national interests in aeronautics that we are confident will lead eventually to even the most isolated hamlet. The National Aeronautic Association realizes its responsibility, and it is firm in the trust that it will fulfill effectively the functions involved in its work.

Dawn of A New Era in Passenger Transportation

By C. P. Burgess

Aeronautical Engineer Bureau of Aeronautics U. S. Navy

Mr. C. P. Burgess, is one of the world's foremost airship engineers, having represented the Navy Department in England, during the investigation and hearings concerning the design and manufacture of the rigid airship ZR-2, and the causes which led to her destruction. He was intimately concerned with the design of the ZR-1, the Navy's rigid airship, now being built at Lakehurst, N. J. Mr. Burgess is at the present time in the Bureau of Aeronautics of the Navy Department, engaged in engineering in connection with the Navy's airship program.

Editor

FOR countless ages the power to cleave the air upon wings seemed to earthbound man so desirable, and withal so sublime, that the possession of wings has been esteemed an attribute of gods and angels. At times some bold and perhaps irreverent genius attempted to make for himself wings in the image of the beasts of the air; but in spite of the apparent ease with which the large soaring birds maintain themselves aloft upon outstretched and motionless wings, all efforts of man to imitate them failed utterly.

Nature presents to man not only the spectacle of the flying bird, but also clouds and smoke floating upon the atmosphere; and while the largest bird weighs only a few pounds, a single cloud may contain thousands of tons of water. The startling idea of imprisoning a cloud of smoke and floating upon it in the air occurred to a Frenchman in the 18th century, and from this idea was born the hot air balloon in which man first ascended from the earth.

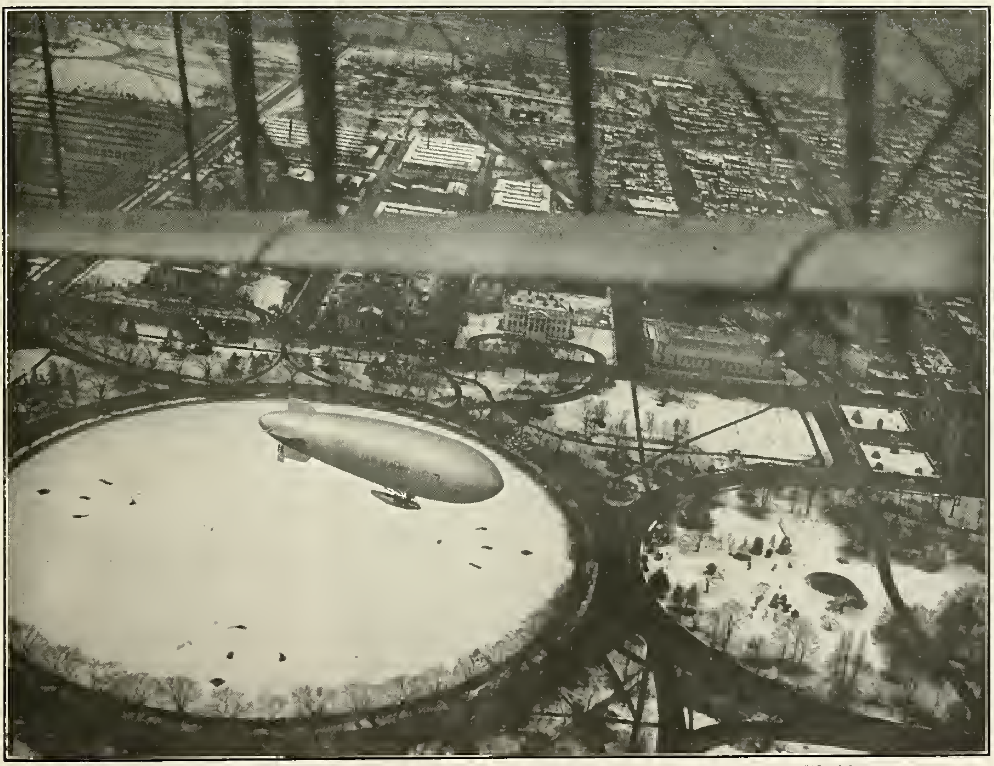
The development of mechanical power during the 19th century culminated in the marvelously light and powerful gasoline engine of our times. Equipped with this engine, man found himself able to fly upon wings, or to construct veritable ships of the air, capable of navigating the atmosphere by mechanical power to any desired objective, and yet floating as independently of that power as the clouds or as ships upon the seas.

The airplane, like the bird, is swift, but limited in size, while to the airship there appears to be almost no limit of dimensions except financial considerations. With the airplane, increasing size offers no gain in economy of power, for at a given speed, the engine power required is directly proportional to the weight of the airplane and its load. Moreover, the useful load which an airplane can sustain is found to be less in proportion to the gross weight in very large machines than in smaller ones. Finally, the difficulties of landing and the necessary size of the landing field are found to increase with the dimensions of the airplane, so that the dangers entailed in a forced landing increase also.

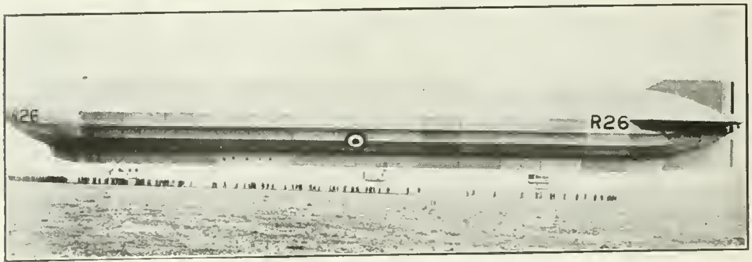
For the airship, on the other hand, the advantages of increasing dimensions are manifold. The buoyancy derived from the air is directly proportional to the volume of the airship, and the volume in turn proportional to the product of three dimensions, length, breadth and depth. Thus, if we double the dimensions of an airship we get eight times as much buoyancy or lift. The lift derived from a wing is proportional to the area, and this is proportional to only two dimensions, so that to double the dimensions of an airplane gives only four times the lift. The resistance of either an airship or an airplane is also proportional to the area, so that to double the dimensions of either type of aircraft is to multiply the resistance and the power absorbed by four. It follows that with increasing size the airship becomes more economical in power and fuel consumption, and also less bulky in proportion to its weight, compared with the airplane. Finally, increasing size has for the airship the advantage of reducing the proportion of the structural and machinery weight to the gross weight. It is clear, therefore, that merely by the expedient of increasing the dimensions, it is possible to increase indefinitely the useful load, the speed, and the range of flight without refueling an airship, while in the airplane increase in size presents no such advantages.

All history teaches that facility of communication is one of the most potent physical aids to the progress of civilization. The development of aircraft gives to the world not only the most rapid of all means of transportation, but also, for the first time, it is possible to voyage in all directions almost regardless of terrain, and independently of permanent ways. By analogy of history, aircraft should minister to new strides of civilization.

The new era will fail, however, to fulfill its bright promises unless safety can be assured. It appears impossible that the danger of forced landings in airplanes can ever be wholly eliminated, and the forced landing of a large passenger-carrying plane in darkness or fog on anything but on a favorable terrain is unpleasant to contemplate. The large airship, on the other hand, may have a dozen or more engines and be capable of good speed with only a third of them in operation, so that the danger



The first helium filled airship in the world, the Navy Blimp C-7 over "ellipse" at Washington



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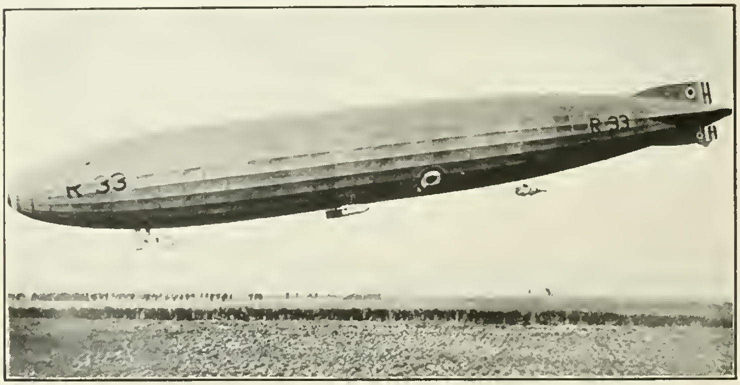
An early type of rigid airship, the R-26, at Hendon, England. It will be noted that this is a straight sided ship lacking the stream lines of the R-33 and R-34

of a forced landing due to engine trouble is eliminated.

It is sometimes thought that the airship resembles a toy balloon and collapses when punctured. This is only true of the small non-rigid airship consisting of an envelope of fabric maintained in shape by gas pressure. The large rigid airships developed in Germany, and later in England, have structures of aluminum alloy and steel wire, which maintain the form independently of the gas pressure. Within this structure there is a multiplicity of gas bags like the water tight compartments of a ship, so that the complete loss of gas in one, or even in several bags, may be compensated for by discharge of ballast or fuel, and by no means entails a forced landing. Moreover, the gas pressure in these bags is so low and the volume of the gas so great that the rate of loss of gas through a fairly large vent, is small, and affords ample time to effect emergency repairs while in flight by application of an adhesive patch to the wound. Even if a forced landing should occur with an airship, the fact that it can be made at no speed, instead of from 45 to 60 miles an hour, necessary with an airplane, means that injury to the passengers is unlikely, although the airship herself may subsequently break up if the wind is strong and a large number of men to hold her are not available.

The recent loss of the British rigid airship R-34 bears eloquent testimony to the safety of travel in such airships. By an error in navigation the R-34 collided violently with a mountain in the darkness of the night. For an airplane this disaster would probably have involved the death or serious injury of all on board. In the R-34 the crew were unhurt, but the airship suffered structural damage and three of the five engines were placed out of action. Crippled as she was, and against strong adverse winds, the R-34 made her way back to her base, which she reached about twelve hours after the accident. A successful landing was made, but owing to the violence of the wind, the landing party was unable to get the airship into her shed. She was then moored to the ground by three wires in exactly the same manner that she was secured at Mineola, Long Island, upon the occasion of her famous round trip voyage across the Atlantic in the summer of 1919. This is admittedly a temporary expedient and no more desirable in a high wind than anchoring a disabled steamship off a lee shore in a gale. The R-34 jerked at her mooring lines until large holes were torn in her, and from loss of gas she began to strike against the ground, gradually demolishing the whole forward half of the vessel. The important point is that in none of the links of disaster was anyone injured, and recent developments have made each link avoidable.



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The R-33 at Hendon, England, on her trial trip

The primary cause of the loss of the R-34 was an error in navigation by which the airship went 60 miles off her course. The radio direction finder enables an airship pilot to obtain the bearing of two or more land stations at any time, so that he can find his position on the map with exactitude, and errors of navigation are, therefore, now avoidable.

By far the most important recent development has been the mooring mast. A great drawback to the use of the airship hitherto has been that at the beginning of every voyage the vessel must be taken out of a shed,

© Navy Official Photo

Passenger car of the post-war Zeppelin "Bodensee". The ship has just landed on one of her periodic flights from Copenhagen to Berlin

and at the end of a voyage it must be put in again. The cost of an airship shed is very great, and a large force of men is required to handle an airship entering or leaving the shed. No means of mooring an airship outside its shed existed, except the unsatisfactory expedient of the three wire system used with the R-34. Attempts were made to solve the problem by securing the bow of an airship to a steel lattice mast or tower called a mooring mast. For long the experiments were disappointing because it was found that the airship was subject to severe jerks and strains while being hauled to the mast. Now the difficulty has been overcome, and, in England, the R-33, sister to the R-34, has for months been riding to a mast in all weathers, and leaving or coming up to the mast with the services of only a few men on the ground. This most serious problem solved, the rigid airship may be operated in any weather without fear that she will break up at her journey's end because of inability to enter her shed. Airship sheds will be necessary only at the principal terminals for docking purposes. Mooring masts should be distributed about the country and maintained as a Government charge, like lighthouses upon our coasts. In peace and in war they will be an invaluable asset to the nation.

An airship inflated with hydrogen is exposed to the terrible danger of fire in the air. Yet this danger is much less than is generally supposed, for hydrogen must be mixed with air in order to burn, and even incendiary bullets, which finally stopped the German airship raids upon England, will set fire to an airship only when fired into the gas bags in great numbers until escaping jets of hydrogen are ignited by incendiary bullets following close behind others. German airships have been struck by lightning so that the metal girders were fused in places, but the gas was not ignited.

With helium as a buoyancy medium, even those dangers are eliminated.

The primary danger of fire in all types of aircraft is from gasoline vapors around the engine. Airships require less power in proportion to weight than airplanes, and it seems probable that in the near future as safe and sturdy heavy oil engines will be developed for airship use, eliminating the dangers of gasoline vapors.

Finally with heavy-oil engines and the use of helium, the last serious dangers to airships will be removed, and travel by air will be safer as well as swifter, more comfortable, and infinitely more interesting and inspiring than travel of any other sort.

Standardization and Aerodynamics

SINCE the latest article on Standardization and Aerodynamics by William Knight has been published in the December issue of AERIAL AGE, we have received a number of letters commending us for the campaign that we have started in July 1921 in favor of an effective international cooperation in aeronautical scientific and research work.

Letters of appreciation of the timely suggestions contained in the series of articles on this subject which we have published during the last two years have been addressed to us by the League of Nations, by the National Advisory Committee for Aeronautics, by the National Aeronautic Association of the U. S. A., by aircraft manufacturers, officials of foreign governments, European research laboratories and the aeronautical press.

The following editorial comment appearing in the January 17th issue of "The Aeroplane" is a complete endorsement of our suggestions and we are glad to reproduce the views of the authoritative British Aeronautical Review on the vital matter of international cooperation of scientists and technical men working in aeronautics.

International Co-operation in Aeronautical Research

The appearance of a new German textbook on aerodynamics Handbuch der Flugzeugkunde, Vol. II "Aerodynamik" by Fuchs and Hopf, Published by Richard Carl Schmidt & Co. Berlin, and the publication of a series of articles in Aerial Age on "Standardization and Aerodynamics" draws attention to a subject which is of very considerable importance to the progress of knowledge in aeronautics. At the present moment there are aerodynamical laboratories of one sort or another in practically all civilized lands, and in those laboratories earnest seekers after knowledge are attempting to lay the foundations of an orderly knowledge of aerodynamics.

Obviously, unless all who are actively concerned with the science of aeronautics are fully informed of the results achieved by other workers in the same field there is likely to be a considerable waste of effort, and a correspondingly slower progress along the desired path. In the present stage of civilization difficulties due to difference of language as between various nations represent relatively little hindrance to the free exchange of ideas. Other and more artificial difficulties are in fact a much greater obstacle to the spread of knowledge than any difference of tongue.

These difficulties had their origin before the War, but the War has very considerably aggravated them.

Artificial Obstacles to Mutual Understanding

Among these obstacles are the absence of any internationally accepted system of units for aeronautical measurements, the lack of agreement as to a standard method of exhibiting the results of tests, and the serious discrepancies in the experimental results obtained by laboratories in different parts of the world.

These three difficulties are of importance to the practical engineer as well as to the scientist or research worker. A strange system of units is at best a nuisance, and at worst it may lead to serious errors. A polar diagram exhibiting the qualities of a particular wing section may convey nothing to one who is accustomed to the type of curve common in his country, and if he wishes to interpret it he must convert it to a more familiar form. And as he probably knows that the different wind channels of the world often disagree violently in their measurements on similar bodies he will very probably not trouble to convert it at all—simply because the results being of a different origin there is no certainty that they are accurately comparable.

Aerodynamical Units

The standardization of aerodynamical units presents no insuperable difficulty. Three systems of units are in use by the main aerodynamical laboratories of the world. The kilogramme-meter-second system introduced in France by M. Eiffel and standard in all Latin countries—the so-called "absolute" non-dimensional system adopted by the N. P. L.—and the German non-dimensional system. These three are connected by very simple numerical relations and any one of them would form a satisfactory working system.

The German system is possibly the most logical and the most convenient for scientific work, the British is little inferior, and would probably be more easily acceptable in certain quarters than would the German.

These seem to be very good reasons for standardizing the polar diagram as the method of expressing wing characteristics in a graphic form. This form of curve lends itself more directly to the construction of curves exhibiting the characteristics of a complete aeroplane than does the form more usual in Britain—but more important still is the fact that it is standard in every country except Britain and the United States—and it is very probable that it will shortly be adopted as a standard in the latter country.

Aerodynamical Units
Divergencies Between Wind Tunnels

The discrepancies between the results obtained by different wind tunnels are not so easily to be overcome. The N. P. L. some time ago arranged to construct a series of models, and to send these models on a tour of various aerodynamical laboratories, in order to obtain some evidence as to the extent of the concordance or otherwise between various wind tunnels. It is understood that the models are now on their travels, but unfortunately owing to political considerations all ex-enemy laboratories have been excluded from the programme.

(Which is obviously mere silly pandering to French prejudice. Ed.)

Also it would appear that certain of the authorities to which the models have been or are to be forwarded consider that the N. P. L. have devised the tests which it desires to be carried out without proper consultation with themselves, and there appears to be some risk that the tests will be even more restricted than was originally intended.

Even so incomplete a series of tests will have a certain value and may help to clear up some of the present uncertainties, but very obviously the full advantage of any such an attempt to discover the real extent of divergence between the world's aerodynamical laboratories, and to account for and if possible remove the errors can only be gained if all the important laboratories—including those of Germany—take part in the tests in the right spirit.

The Need for Co-operation

This object could only be obtained as the result of co-operation between all the parties concerned. A very strong plea in favour of arranging for an interchange of views in order to arrive at an agreement both upon the standardization of unit and of symbols, and as to a programme of tests intended to clear up the question of the apparent differences between experimental results obtained at different laboratories has recently been made in America by Mr. W. Knight. A series of articles on the subject of standardization in aerodynamics written by Mr. Knight have appeared in "Aerial Age" of New York.

From these articles it appears that in general the aerodynamists of all countries are agreed in principle as to the desirability of such action. The main obstacles to any really international attempts to reach an agreement as to such action are of a political nature. The more important aerodynamical laboratories of the world are Government institutions. Certain Allied Governments would very certainly refuse to be represented even at a purely technical conference of this nature which was attended by German representatives. Under present conditions the American Government refuses to be officially represented at any international conference whatever—and such a conference unattended by a representative of the American Advisory Committee for Aeronautics would be of limited practical value. It seems that if once the Allies generally can be persuaded to admit German representatives to an international aerodynamic conference the difficulty as to American representation might be overcome.

It is certainly ridiculous to attempt to ignore Germany in this respect. In so far as the science of aerodynamics is concerned Germany at the present moment certainly leads the world and to attempt to boycott her representatives in such matters is merely to refuse to take full advantage of the advance in knowledge due to German effort.

It is probably useless to expect any action to the desired end to originate from France. Since the change in Government in Italy, that country can scarcely act.

Britain could and should take the initiative in this matter. The subject would need to be approached with considerable circumspection in order to avoid to the utmost extent the inevitable political outcry which would arise in certain quarters.

Fairly certainly some of our late allies would refuse to be represented at any conference which resulted. Equally certainly Germany and all the neutral States of any importance would accept, and if the difficulty of American representation could be overcome—as for instance by calling the American delegate an "observer"—the resulting agreement, if one were reached, would be of very much greater practical value than any result of a conference from which Germany was excluded.

Practical difficulties of a very serious nature stand in the way of the success of such a conference. It would be too much to expect the German representatives to refrain from laying stress on the hardships imposed on them by the clauses of the Treaty of Versailles which regulate Germany's aerial activities. On the other hand, however much their fellow delegates from other lands might sympathize with the hard lot of their German fellow workers it would be entirely improper, and probably disastrous, for a congress of this nature to allow itself to discuss such political questions as are involved in this matter.

Britain, America, and Germany, of all the nations who were involved in the late War, have the characteristics most likely to lead to an orderly discussion of the essentials of this question. And an agreement on the matters discussed above by those three nations would in time certainly be accepted by every aerodynamical scientist throughout the civilised world.

W. H. S.

Program for the National Aeronautic Association of the U. S. A.

Since the National Aeronautic Association of the U. S. A. has been formed, a new and a very important factor in aeronautics has been created.

The President of this Association, Howard E. Coffin, is one of the men who originally started to work along the line of standardization.

One of the purposes for which the National Aeronautic Association has been created is: "to promote the study for the advancement of aerial navigation of every nature, and to hold and conduct conferences and congresses for the purposes of such studies."

AERIAL AGE will welcome any authoritative aeronautical organization which will take the initiative in calling the international congress that we have been advocating during the last two years. We hope, however, that either the National Aeronautic Association of the U. S. A. or the National Advisory Committee for Aeronautics or both, will see the desirability from every point of view, of taking the lead in the movement which was started four years ago by William Knight, at that time, technical representative in Europe of the National Advisory Committee for Aeronautics.

(Concluded from page 123)

The Weather Bureau has co-operated also in many other enterprises, such as the recruiting trip of the NC-4; several trans-continental flights, including that from New York to Alaska; National and International Balloon Races; the recent trip of the C-2; etc., etc. In all cases this service has been keenly appreciated, as indicated by numerous statements of commendation, both written and oral. It has been apparent however, and, is clearly recognized by all concerned, that a similarly intensive service must be available, not merely along some particular route at some particular time, but *over practically the entire area of this country at all times.* Aviation is developing rapidly and will soon be a large factor commercially. It is essential, or rather it is vital, that meteorological service be developed and enlarged to meet the added demands that will be made upon it. Realizing this, the Weather Bureau has consistently sought added appropriations to make expansion possible. The lines along which development would proceed are set forth in appendix C of the report of the National Advisory Committee for Aeronautics, sent to the President on April 9, 1921, and transmitted by him to Congress on April 19, 1921. Briefly, the program contemplates the establishment of aerological observing and reporting stations at, or close to, all flying fields; also, at suitable intervals along all cross-country air routes. In addition there would be a large number of non-instrumental stations, from which reports of thunderstorms, squalls, fogs, poor visibility and other conditions inimical to flying would be received. The Weather Bureau is fortunate in being able to enlist the services of a large number of men who now act as co-operative observers and who could be engaged for this service at comparatively small cost and with little additional training.

Such in rough outline is the plan. Experience would, of course show where modification could appropriately be made, enlargement here—curtailment there. These are details. The all-important thing now is to get the general scheme started, and the one proposed makes a good beginning. Efforts to make possible this beginning through added appropriations have thus far been unavailable. It is earnestly hoped that such efforts will have their reward in the near future.

Note on the Interpretation of Wind Tunnel Experimental Data with Reference to the Longitudinal Damping Characteristics of an Airplane

THE PRESENT note is concerned with the application of stability theory (as developed by Bryan, Bairstow, and others) to the data obtained by what may now be considered routine tests on the model airplane. In addition to the usual determination of lift, drag, and pitching moments on the complete model, it is now becoming the universal practise to remove the horizontal tail surfaces, and to determine the pitching moments for the model minus the tail-plane. Such a procedure yields a comparatively large amount of information.

Let the characteristics of the complete model be expressed in the standard forms:

$$C_L = \frac{L}{qS}\ ;\ C_D = \frac{D}{qS}\ ;\ \text{and}\ C_M = \frac{M}{q\,S\,c}$$

where L=lift, D=drag, M=pitching moment, q=dynamic pressure, S = wing area, and c = wing chord. The lift and drag coefficients C_L and C_D, and the moment coefficient C_M, for the complete model are, of course, non-dimensional. The dynamic pressure for standard conditions is $q = \frac{1}{2}\rho V^2 = .001185\ V^2$ with the velocity V in ft. per sec.

Stalling-moments are taken positive.

For present purposes we will take the moment coefficient for the machine minus the tail-plane as

$$C_{Mw} = \frac{Mw}{q\,S\,c}$$

and for the moment coefficient of the tail-plane about the center of gravity

$$C_{Mt} = \frac{Mt}{q\,S\,c}$$

In order to obtain exactly the effective moment due to the tail it is really necessary to test the remainder of the model in the *presence* of the tail-plane. This, however, usually presents some experimental difficulties if the work is to be done accurately, so, here, it will be assumed that, with sufficient approximation we can obtain

$$C_{Mt} = C_M - C_{Mw}$$

by simply taking moments with and without the tail-plane.

In the subsequent analysis we shall neglect slip-stream effect, due to the fact that the effect of the increase of velocity over the tail is to a very large extent neutralized by the change in the angle of downwash due to slip-stream. We will deal only with level flight conditions.

Choose a set of rectangular coordinate axes fixed in the airplane, with the origin at the center of gravity, and initially perpendicular and parallel to the flight path. When the airplane oscillates these axes move with it, and there will of course be components of the resultant velocity along these axes. It is important to note, however, that at the instant the motion begins the vertical, or z-axis, is parallel to the direction of lift and the x-axis parallel to the direction of drag. As regards signs: z and x are taken positive in the sense of the lift and drag, at the start of the motion. For a body having only three degrees of freedom, the equations of motion, with moving axes, take the forms

$$\frac{W}{g}\left(\frac{du}{dt} + wq\right) = X$$

$$\frac{W}{g}\left(\frac{dw}{dt} - uq\right) = Z$$

$$\frac{Wk^2}{g}\,\frac{dq}{dt} = M$$

where $u = \frac{dx}{dt}$ = velocity parallel to the x-axis, in the opposite sense to the velocity of translation.

$w = \frac{dz}{dt}$ = velocity component along z-axis.

$q = \frac{d\theta}{dt}$ = angular velocity in pitch (about lateral y-axis through the c. g.), when θ is the angle of pitch taken positive for stalling.

k = pitching radius of gyration.

M = pitching moment about lateral axis.

W = weight.

X = force component parallel to x-axis.

Z = force component parallel to z-axis.

t = time.

g = gravitational acceleration.

Now experimental results, based on stability theory, show that the variation of the velocity along the flight path is small, and that, for all practical purposes, when the oscillations are small, we can take u = — V when V is the mean forward velocity of the airplane. Lanchester, in his phugoid analysis (Aerodynamics), shows that the period of the long oscillation associated with the variation of forward velocity is given approximately by

$$t = 2\pi\frac{V}{g}$$

where t is the periodic time. Recent experiments by the N. A. C. A. have shown that, in actual flight, the period of the long oscillation depends only slightly on the pitching moment of inertia of the airplane. Furthermore, for nearly all airplanes this long period is a considerable fraction of a minute (or even longer). For which reasons enumerated we will neglect the variations in both X and V, the term wq being small. In this case the variation in the propeller thrust will also be negligible and the total pitching moment acting at any instant after the start of the oscillation will be

$$M = M_o + dM - h\,T$$

where T is the propeller thrust and h its moment arm, taken positive upward.

Now we note that

$$dM = \frac{\delta M}{\delta w}\,dw + \frac{\delta M}{\delta q}\,dq$$

but, since initially, $M_o = hT$, and $w_o = q_o = O$; then w = dw and q = dq. Therefore,

$$M = \frac{\delta M}{\delta w}\,w + \frac{\delta M}{\delta q}\,q$$

Similiarly, considering the equilibrium of the machine in the vertical direction, it is easily shown that

$$Z = \frac{\delta Z}{\delta w}\,w + \frac{\delta Z}{\delta q}\,q$$

We then obtain the equations

$$\frac{dw}{dt} + Vq = w\,Z_w + q\,Z_q \quad (1)$$

$$k^2\,\frac{dq}{dt} = w\,M_w + q\,M_q \quad (2)$$

in which Z_w, Z_q, M_w and M_q are the partial derivatives divided by the mass of the airplane; that is, for example, $Z_w = \frac{\delta Z}{\delta w}\frac{g}{W}$

Since we are dealing with small oscillations, and since the above partial derivatives are to be determined graphically from the experimental data, we will consider Z_w, Z_q, M_w, and M_q as constants, over the range of values of w and q with which we will have to deal. Our problem then becomes the very simple one of solving two linear differential equations with constant coefficients. Differentiate (2) with respect to t, eliminate $\frac{dw}{dt}$ from the resulting equation and (1), and then, finally, substitute the value of $q = \frac{d\theta}{dt}$; we obtain the linear third order equation,

$$\frac{d^3\theta}{dt^3} + a\frac{d^2\theta}{dt^2} + b\frac{d\theta}{dt} = O. \quad (3)$$

in which, for the sake of brevity, we have used the notation,

$$a = -\frac{M_q + k^2 Z_w}{k^2}$$

$$b = +\frac{M_q Z_w - M_w(Z_q - V)}{k^2}$$

A similiar equation, with identical coefficients, is, of course, obtained for w.

Writing (3) in the symbolic operational form, using D to denote differentiation with respect to t,

$$(D^3 + aD^2 + bD)\theta = O$$

the roots of D obviously being:

$$O,$$
$$-\tfrac{1}{2}a - \sqrt{a^2/4 - b},$$
$$-\tfrac{1}{2}a + \sqrt{a^2/4 - b}.$$

the solution is obviously of the form (See Edwin B. Wilson "Advanced Calculus"):

$$\theta = e^{-\frac{at}{2}}\left\{C_1 e^{t\sqrt{a^2/4 - b}} + C_2 e^{-t\sqrt{a^2/4 - b}}\right\} + C_3$$

the three C's being the constants of integration. The motion is damped if a is positive, and undamped if negative. If a is zero and $b > O$, the motion is simple harmonic. There remain three possible cases of the radical expression to be considered, viz.,

(1) $b < a^2/4$
(2) $b = a^2/4$
(3) $b > a^2/4$.

In the first two cases the exponents are real and the motion non-oscillatory. In the third case the exponents are imaginary and the motion periodic. Reducing the terms in e to the trigonometric form, we find

$$\theta = e^{-\frac{ta}{2}}\left\{A \sin t\sqrt{b - a^2/4} + B \cos t\sqrt{b - a^2/4}\right\} + C$$

where A, B, and C need not be specifically determined here. The period of the oscillation is

$$T = \frac{2\pi}{\sqrt{b - a^2/4}} \quad (4)$$

The logarithmic decrement, defined as the ratio of amplitudes at intervals of time equal to the period T, can easily be verified by the reader to be given by

$$\log\frac{\theta_0}{\theta_1} = \text{const.} = \frac{aT}{2} \quad (5)$$

We will concern ourselves with the development of a satisfactory criterion for the development of damped periodic motion of the airplane. While it is true that, as shown, the motion may be damped (stable), but non-oscillatory, such a condition would likely be associated with too large pitching moment of inertia, and poor manœuverability. Professor Edward P. Warner (Massachusetts Institute of Technology) has suggested as a stability criterion the ratio of the time to damp to half amplitude of the period. If it is the time required to reach a given amplitude θ, the reader can easily verify that

$$\log\frac{\theta_0}{\theta} = \frac{at}{2}$$

and hence for $\frac{\theta_0}{\theta} = 2$

$$t = \frac{1.386}{a}$$

Designate the stability coefficient by C_s and we have

$$C_s = \frac{t}{T} = \frac{1.386\sqrt{b - a^2/4}}{2\pi a}$$

Or simply

$$C_s = \frac{0.221\sqrt{b - a^2/4}}{a} \quad (6)$$

The condition of damped periodic motion, $b > a^2/4$ simplifies to

$$M_w < \frac{(M_q - k^2 Z_w)^2}{4(Z_q - V)k^2} \quad (7)$$

It is to be noted that, for $Z_q = O$, the above criterion becomes identical, in form, to that given by Dr. Max Munk in N. A. C. A. Report No. 133 under the title "The Tail-Plane."

Determination of Resistance Derivatives.

I. To obtain M_w note that

$$\delta M = \frac{\delta M}{\delta \alpha}\delta\alpha$$

where α is the wing angle of attack to which the pitching moment curve for the machine is referred. But approximately $\alpha = -57.3\frac{w}{V}$; then

$$\frac{\delta M}{\delta w} = -\frac{57.3}{V}\left(\frac{\delta M}{\delta \alpha}\right)$$

and hence

$$M_w = -\frac{57.3\ g}{VW}\left(\frac{\delta M}{\delta \alpha}\right)$$

Here $\frac{\delta M}{\delta \alpha}$ is the slope of the pitching moment curve for the full size machine at the given velocity, V. As model tests show that, at a given angle of attack the slope of the moment curve is nearly independent of elevator (or stabilizer) setting, we can write

$$M_w = -\frac{57.3\ g}{VW}qSc\left(\frac{dC_M}{d\alpha}\right)$$

But since $W = C_L qS$, then

$$M_w = -\frac{57.3\ g\ c}{V\ C_L}\left(\frac{dC_M}{d\alpha}\right)$$

II. To obtain Z_w note that with moving axes,

$$Z_o + dZ = (L_o + dL)\cos d\alpha + (D_o + dD)\sin d\alpha$$

Placing $\cos d\alpha$ equal to unity and $\sin d\alpha = \left(\frac{d\alpha}{57.3}\right)$ and noting that under initial conditions, $L_o = Z_o$ we obtain

$$\frac{dZ}{d\alpha} = \frac{dL}{d\alpha} + \left(D_o/57.3\right)$$

But, again, since $W = C_L qS$, and $\alpha = -57.3\ w/V$, we have

$$Z_w = -\frac{g}{C_L V}\left(57.3\frac{dC_L}{d\alpha} + C_D\right) (9)$$

III. Determination of Mq:

The damping in pitch is due largely to the action of the tail surfaces. Experiments seem to indicate that for ordinary tractor machines from .8 to .9 of the total value of M_q is contributed by the tail-plane. Let us denote by f the ratio of the tail M_q to the value of M_q for the entire machine. The effective moment of the tail-plane (M_t) is found by determining both the moments with and without the tail-plane and then computing the coefficients; thus

$$C_{Mt} = C_M - C_{Mw}$$

If α_t is the mean effective angle of attack of the tail and ϵ the mean downwash angle, then

$$d\alpha_t = d\alpha - d\epsilon$$

Therefore

$$\frac{dM_t}{d\alpha_t} = \frac{1}{\left(1-\frac{d\epsilon}{d\alpha}\right)}\left(\frac{dM_t}{d\alpha}\right)$$

During the oscillation we have approximately

$$\alpha_t = 57.3\,\frac{rq}{V}$$

where r is the effective lever arm of the tail-plane (center of pressure assumed constant at 33% of mean chord.) Then

$$\frac{\delta M_t}{\delta \alpha_t} = \frac{V}{57.3\, r}\left(\frac{\delta M_t}{\delta q}\right)$$

Next, noting that $M_t = C_{M_t} qSc$, and making the substitutions indicated above, we obtain

$$M_q = \frac{57.3\ r\ g\ c}{C_L V\left(1-\frac{d\epsilon}{d\alpha}\right) f}\left(\frac{dC_{M_t}}{d\alpha}\right) \quad (10)$$

IV. There is some uncertainty about the determination of Z_q, which, however, is comparatively so small that it is usually neglected in approximate calculations. The change of Z with angular velocity in pitch is due to both wings and tail-plane; but principally to the latter. It is probable that the British obtain a fair estimate by assuming that

$$Z_q = \frac{f\ M_q}{r} \quad (11)$$

From (10) and (11), then, we find

$$Z_q = \frac{57.3\ g\ c}{C_L V\left(1-\frac{d\epsilon}{d\alpha}\right)}\left(\frac{dC_{M_t}}{d\alpha}\right) \quad (12)$$

The downwash may be easily determined by exploration with the tail-plane; but, again, unless the tail-plane is greatly shielded or portions of the wings are cut away in the vicinity of the body, one can use, with good accuracy, the familiar approximation $\frac{d\epsilon}{d\alpha} = \frac{1}{2}$. In regard to M_q, formula (10) should give a good estimate, except in rare cases in which the tail-plane is very small, or greatly shielded by a large fuselage. In such exceptional cases the oscillator should be used.

In conclusion: It should be noted that, in computing the coefficients M_q, Z_w, etc., by formulas (8) to (11) care must be exercised in substituting the derivatives, taken from the characteristics of the machine, with their appropriate signs. The sign of V only need not be considered as, at the outset, we substituted (—V) for u in the equations of motion.

Wright Patent Expires This Year

THE WRIGHT patent expires May 22, 1923, after 17 years of an up-and-down career, with the brothers Wright battling for their reward for almost a decade. It seems but yesterday when we were trying to tell the world the Wrights had flown, yet a score of years will soon have passed since Kill Devilians saw the birth of a new transportation, a transportation even now in its American swaddling clothes.

On May 23, the airplane manufacturing field will be free to all comers, American and foreign, save, perhaps for the Montgomery patent, which, however, expires September 18, 1923, though this still remains to be adjudicated. (No. 831,173, issued Sept. 18, 1906).

Its adjudication is now a possibility. Both sides in the litigation now pending in the Court of Claims between the heirs of Prof. J. J. Montgomery and the Government for payment of royalties on war-built airplanes, have completed testimony-taking.

If the Montgomery patent, by any chance, is held valid, and the Federal court's opinion overthrown as to the value of the patent in the Wright-Curtiss suit, the Government may pay a royalty fee on the 13,894 airplanes built or purchased during the war, and on those bought subsequently as well. The manufacturers may then be called on in another suit to pay royalty on all other machines constructed since. The Montgomery claims total 45, beginning with one covering "a curved wing with means for changing its curvature," followed by others in modification.

Montgomery's Glides of 1905 Beat Hentzen's of 1922

Hentzen's glides are overshadowed by the acrobatic feats of Maloney, Wilkie and Dofolco, daredevil airplane riders of 1905, employed by Montgomery in testing and subsequently in a series of exhibitions in a number of California cities.

"On one occasion, Maloney in trying to make a very short turn during rapid flight pressed very hard on the stirrup which gives a screw shape to the wings and made a side somersault," wrote Montgomery in 1909 to the author of this article.

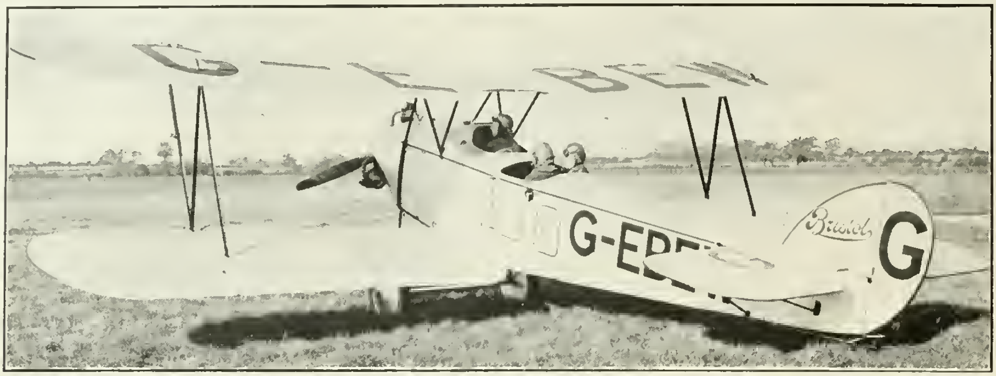
"The course of the machine was very much like one turn of a corkscrew. After this movement, the machine continued on its regular course. And afterwards Wilkie, not to be outdone by Maloney, told his friends he would do the same, and in a subsequent flight, made two side somersaults, one in one direction and the other in an opposite, (witnessed by thousands of people), then made a deep dive and a long glide, and when about three hundred feet in the air, brought the airplane to a sudden stop and settled to the earth. After these antics, I decreased the extent of the possible change in the form of wing surface so as to allow only straight sailing or only long curves in turning."

During his work Montgomery offered to cover a thousand dollars to send the airplane up upside down and if the machine did not immediately right itself, make a flight and come safely to the ground, with a sack of sand in the rider's seat, the money would go to the opposite side. The bet was never taken.

On April 29, 1905, from the college grounds at Santa Clara, Calif., Montgomery sent up an ordinary hot-air balloon, to which was attached a 45-pound glider, with Daniel Maloney, an old-time parachute jumper, in the seat.

At a height of about 4000 feet the airplane was cut loose from the balloon and commenced to glide to the ground. "In the course of the descent the most extraordinary and complex maneuvers were accomplished—spiral and circling turns being executed with an ease and grace almost beyond description, level travel being accomplished with the wind and against it, figure eight evolutions performed without difficulty, and hair-raising dives were terminated by the abrupt checking of the movement by

(*Concluded on page* 142)



The Bristol Three-Seater Airplane

The Bristol 3-Seater Airplane

A Taxiplane Designed to Compete Economically with Road Transport

General Description

The "Bristol" 3-seater Airplane is a single-engined Tractor Biplane, designed to carry two passengers, in addition to pilot, with a considerable amount of baggage. The whole construction of machine and power unit installation has been considered from the standpoint of the owner-pilot, and calls for the minimum quantity of spare parts.


The Motor Installation of the Bristol Three-Seater

Engine Installation

The "Bristol" Lucifer engine is mounted on a readily removable swinging mounting, which gives instant access to the back of the engine for adjustment of magnetos and carbureters and dispenses with the necessity for removable cowling.

A steel fireproof bulkhead is fitted behind the engine, and all control connections pass through fireproof glands.

Carbureter intakes are carried through the bottom side of the engine cowling, eliminating any possibility of petrol accumulating.

Pilot's Cockpit

The pilot's cockpit is immediately behind the engine, and is fitted with controls of the stick and rudder bar type. The view for landing is extremely good.

Passengers' Cockpit

The passengers' cockpit is immediately behind that of the pilot, and seats the two passengers side-by-side on a comfortably upholstered seat, entrance being by means of a door in the side of the fuselage. A detachable top, converting the cockpit into an enclosed cabin, can be supplied.

Baggage Hatch

The baggage hatch is immediately behind the passengers and can accommodate two large suit cases.

Gasoline System

The gasoline system is pure gravity from a scuttle tank in front of the pilot. A large readily demountable filter is fitted.

Wings

The upper and lower wings are identical and interchangeable. They are of the single bay type and the interplane struts are of "N" formation, requiring no trueing up.

Chassis

The Chassis is of the oleo-elastic type. Elastic rings are used for suspension and can be readily changed. The oleo plungers are fitted with a special type of tapered needle valve to control the passage of the oil through the plunger, to give constant oil pressure throughout the stroke of six inches.

Flying Controls

As mentioned, the controls are of the stick and rudder bar type; all cable pulleys, wherever used, are five inches diameter.

Tail Trimming Gear

The tail incidence can be varied by a lever and quadrant adjacent to the pilot to trim the machine under all conditions of speed and load distribution.

Specification

Dimensions	
Span	31′ 0″
Length overall	23′ 3″
Height	8′ 10″
Weights	lbs.
Machine empty	1,210
25 gals. Petrol	
3 gals. Oil	
Fuel and Oil	215
Pilot	180
Passengers (2)	320
Baggage	75
	2,000
Loading	
Weight / H.P. ("Bristol" Lucifer at 100 h.p.)	20.0
Weight / sq. ft.	7.0
Performances	
SPEED	
At ground level fully loaded	90 m.p.h.
At ground level less passengers and baggage	93 m.p.h.
At 5,000 ft. fully loaded	88 m.p.h.
At 5,000 ft. less passengers and baggage	91 m.p.h.
CLIMB	
To 1,000 ft. fully loaded	2 minutes.

Mechanical Device For Illustrating Airplane Stability

AN instrument for the lecture room which illustrates completely in a qualitative sense nearly every property of a flying airplane with astonishing exactness, allows mathematicians to visualize the actual behavior of an airplane without having to make flights and holds the possibility of mechanically solving stability equations, has been built by the technical staff of the National Advisory Committee for Aeronautics.

This instrument is remarkably simple. It is easy to construct a piece of apparatus which will show dynamic stability or damped oscillations—for example, a pendulum. But a simple device which could be altered to give any degree of stable or unstable motion was long desired. So far as known, this new instrument is the only simple method for accomplishing this.

At first it was expected that only the degree of damping of an oscillation would be illustrated, but as the instrument was more carefully studied it became evident that every property, practically, of an airplane in flight was represented accurately, and this was confirmed by the fact that equations of motion worked out in almost identical form with those of Bryan and Bairstow for the airplane.

The instrument consists essentially of a double pendulum, the lower end of which is a wheel resting on a revolving drum. The drum can be turned at any speed by an electric motor, and the stability and moment of inertia about the two pendulum axes can be varied at will.

The properties of an airplane are represented in the following way:

1. The restoring moment about axis A is the pitching moment about the c. g. of the airplane and represents a static stability or metacentric height.

2. The restoring moment about axis B is the damping of the airplane —Mq.

3. The moment of inertia about A represents the mass of the airplane.

4. The moment of inertia about B represents the moment of inertia of the airplane about the Y axis.

5. The angular motion about A represents changes in airspeed along the path—V.

6. The motion about B represents changes in inclination of the machine in respect to the horizon.

7. The angular movement of the wheel in relation to the drum axis represents the inclination of the path with the horizon.

Just why the above representation is true can not be explained at present, but from actual trial this instrument does behave in this manner. The speed of rotation of the drum has some influence on the characteristics of the motion, but just what this effect is has not yet been determined.

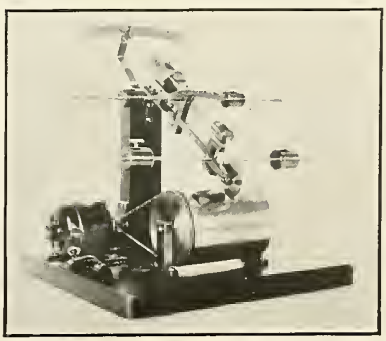


Fig. 1

By adjusting the upper balance weight, any degree of static stability may be obtained and the change from an oscillation to a divergence is clearly illustrated. The oscillation is more stable (greater damping) when either the mass of the airplane (upper lateral weights) is increased or the moment of inertia (lower lateral weights) are decreased as indicated by theory.* The damping is also varied by changing the moment about the lower axis.

An oscillation can be produced which is stable below a certain magnitude and unstable above it. It is also possible to produce an oscillation which will damp down to a finite value and remain there permanently. This is particularly interesting as the same phenomenon has been observed in actual flight.

This particular design of instrument has the disadvantage that the moment of inertia about each axis is changed at the same time as the restoring moment so that the two effects are combined. This can easily be remedied by the use of springs instead of weights, and will be so changed in another instrument.

Theory of the Instrument. Instrumental records taken in flight of the air speed and path angle during an oscillation of constant amplitude show that these variables are, as

*Thomson, "Applied Aerodynamics" —p. 208.

closely as can be determined, sine functions of the time, but are of course at a small phase difference. The path of the airplane in space can not be a sine curve, but in stability calculations the amplitude has been assumed so small that the departure from it is negligible. By assuming small oscillations, angles may be used in place of sines of angles and the usual theory of Bryon and Bairstow can be applied. Working in the same way, W. P. Angel has carried out an analysis of this instrument which gives equations of the same form as for the airplane. In both cases however the oscillations are assumed small and so can not apply strictly to the actual conditions. It is felt that

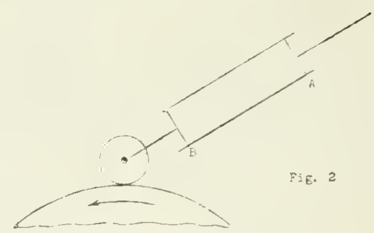


Fig. 2

if an exact solution can be made of the motion of this instrument, we shall have at the same time the exact solution of the airplane motion. It is hoped that mathematicians will interest themselves in this problem.

Uses This instrument is useful for making visible the very complex behavior of the airplane during an oscillation. In several instances new facts were observed on the instrument and later checked in flight. It can also be used for illustrating in the classroom or lecture hall the effect on stability of making changes in the various characteristics of the airplane.

It is hoped that this instrument may be used quantitatively to determine the type of oscillation for a new airplane, by setting the characteristics (mass, moment of inertia, damping, etc.) of this airplane on the graduated scales of the instrument. Whether this can be done or not is difficult to predict, but experiments along this line will be carried out.

(Continued from page 139)

changing the angle of the wing surfaces."

Montgomery began his work in 1883 with a flapping wing machine. In the following two years he constructed models which were tested by dropping them from a cable suspended between two mountain tops. Then a large machine was built with which a number of glides were made. There experiments continued until 1894, and resumed in 1903, ending in the fatal accident to Maloney, in 1905. In this flight, as the balloon was rising with the airplane, a guy rope dropping switched around the right wing and broke the tower that braced the two rear wings and which gave control over the air. Whether Maloney knew of the accident or not, is not known. At about 2000 feet Maloney cut loose, the rear wings began to flap, the machine turned on its back and settled a little faster than a parachute. When Maloney was reached he was unconscious and lived but thirty minutes. The only mark of any kind on him was a scratch from a wire on the side of his neck. The six attending physicians were puzzled as to the cause of his death.

L. W. F. to Market the Eagle-Asp "Ant"

Without waiting for the second coming, or the Winslow Bill or a milky way of aerodromes, the L. W. F. company has up and bought the little "Ant" of Captain Eagle and Lieutenant Asp. When all the "bugs" are worked out and it is turned into a production job, somebody may buy one, if the company isn't careful. An army officer says "the day is going by when traveling by air should necessarily be more expensive than traveling by automobile," and the "Ant" seems to be an example of development along the right line. A machine of this type should sell at a reasonable price and should be manufactured so cheaply that the complete outfit can be placed on the market for $2000, or even less. There would seem to be a possible market for a foolproof, low-priced, efficient, practical airplane that can get up and get down in a comparatively small space.

In the Southern Aerial Derby, last August, Lieutenant Asp won by a wide margin over an SE-5 and a Spad 220, at a speed of approximately 130 miles an hour for 50 miles. This little machine, with a 60 h.p. Lawrance, in a test at Ellington Field, flew 125 miles on 5 gallons of gasoline and it is expected that with a 40 horse engine in a plane like this it can fly close to 100 miles an hour for four hours on 10 gallons of fuel. And, there are no unusual features contributing to the success of the machine, other than extreme lightness and strength of the truss members and the gap of 1½ times the chord.

Eagle and Asp designed the machine without the aid of McCook Field, it is currently reported. Strange as it may seem, look at the darn thing. It's got gaps and stagger 'n everythin'.

The span of the upper wing, which is in one section, is but 18 ft., while the lower, also in one section, spans 14 ft. The chord is 3½ ft. and the gap 5¼ ft. The main support of the two wings are two solid struts running diagonally across each other from the top wing to the lower one, both passing straight through the fuselage, giving them the appearance of a huge "X." The plane is then trussed up at each end of the wings by two x-struts, with a small truss running to the axle. Strength is there. Pancaked from 75 ft., the shock was absorbed in all parts of the wings and nothing was damaged but the landing gear. The stagger of the wings can be changed 4½ inches by loosening four bolts at the bottom of the fuselage. The combined landing gear and struts from the fuselage to the upper wing are in one piece.

The wings have a flexible trailing edge. The engine is the same 60 h.p. Lawrance installed in the "Messenger" and with an ordinary air screw the machine takes off in less than 50 ft. and attains an altitude of 1000 ft. in 30 seconds. The landing speed is about 30 miles. Upon alighting, both ailerons can be pulled down for use as a brake without affecting their normal operation.

Technical Notes of the N. A. C. A.

Since the publication of the list of "Technical Notes" of the National in the January number of Aerial Age, Advisory Committee for Aeronautics there have been prepared by the Committee the following:

111. Stresses Produced on an Airship Flying through Gusty Air. By Max M. Munk, N. A. C. A.
112. The N. A. C. A. Three Component Accelerator. By H. J. E. Reid, N. A. C. A.
113. Report on General Design of Commercial Aircraft. By Edward P. Warner.
114. Supplementary Report on Oilscraper Piston Rings. By H. S. McDewell.

See December number, page 610, for note on the publication of list of all Government publications on aeronautics.

Offices of Aeronautic Intelligence

By William Knight

THE eighth annual administrative report of the National Advisory Committee for Aeronautics which has been recently submitted to the Congress is a document deserving the most careful consideration by that legislative body and should bring about the most generous response from the Bureau of Budget.

The National Advisory Committee for Aeronautics was established by act of Congress, approved March 3, 1915. The organic act charges the committee with "the supervision and direction of the scientific study of the problems of flight with a view to their practical solution, the determination of problems which should be experimentally attacked, their investigation and application to practical questions of aeronautics.

The work of the National Advisory Committee for Aeronautics (N. A. C. A.) is carried through by a number of committees and sub-committees in charge of some particular branch of aeronautical activities. One of these committees is the committee on publications and intelligence whose functions are:—

1—The collection, classification, and diffusion of technical knowledge on the subject of aeronautics to the Military and Naval Air Services, and civil agencies interested, including, especially, the results of research and experimental work done in all parts of the world.

2—The encouragement of the study of the subject of aeronautics in institutions of learning.

3—Supervision of the Office of Aeronautic Intelligence.

4—Supervision of the committee's foreign office in Paris.

5—The collection and preparation for publication of the technical reports, technical notes, and annual report of the committee.

The office of Aeronautical Intelligence of the N. A. C. A. was established in the early part of 1918 as an integral branch of the Committee's activities. It is the officially designated Government depository for scientific and technical reports and data on aeronautics.

Establishment of the Paris Office of the N.A.C.A.

The extension of the activities of the Office of Aeronautical Intelligence abroad to cover technical progress made in Aeronautics in Europe was decided upon on May 1919 following a number of suggestions to that effect contained in a report of mine to the Chief of the Air Service which were adopted by the N. A. C. A.

In May 1919 I was appointed Technical Assistant in Europe to the National Advisory Committee for Aeronautics for the purpose of:—

(a) "to establish and to promote a prompt and cordial exchange of scientific and technical data and information on research and experimental work in aeronautics and sciences thereto allied between the United States on the one hand and the Governments, private institutions and individuals of France, England, Italy, Belgium, Switzerland, Holland and Germany on the other hand."

(b) "to act as the officially accredited representative of the National Advisory Committee for Aeronautics in Europe in all relations with Government officials, private institutions and individuals in the countries named above."

On June 1919 I established the Paris office of the N. A. C. A. and from that date to June 1921, while I was in charge of the activities of the N. A. C. A. in Europe, 50% of the total number of documents communicated to the committee by all sources of information, were obtained in Europe by and through its Paris office. The total expenses involved in the establishment and maintenance of that office for the same period of time was 20,000 dollars, or, 5% of the appropriation of the N. A. C. A. for the fiscal years 1920 and 1921.

Work Done by Our Scientific Attaches During the War

When I suggested right after the war the establishment of a post-war organization for the purpose of continuing, at least in aeronautics, the work of Scientific co-operation between the United States and the allied nations in Europe which had been inaugurated during the war and which had been carried through the offices of Scientific Attaches to the American Embassies in London, Paris and Rome, I was prompted by the fact that the very first offices which were abolished immediately after the armistice were the offices of our Scientific Attaches abroad.

The work done by our Scientific Attaches abroad during the war is not generally known. Scientific work, in general, never gets (and as a matter of fact never expects) the honors which are rightfully paid to military operations in the process of winning a war. Scientific and technical work, however, had their share of responsibility in making possible our winning the war, and the offices of our scientific attaches to the American Embassies in England, France and Italy did their share of work while they lasted.

The best and the most important part of the work done by our Scientific Attaches abroad during the war, in my estimation, was the establishment of a fine spirit of co-operation between European and American Scientists and technical men. As far as I know, we were the first nation which during the war created the office of the Scientific Attache. Up to that time, military, naval and commercial attaches only, constituted the official diplomatic family of Ambassadors. The war conferred upon our Scientific attaches the honor of representing abroad the contribution of American scientists and technical men to the job of winning the war.

As I said before, however, this honor was short lived and with the advent of peace it was not felt any longer the need of diplomatic scientific representation abroad, this need being limited to-day, as it was before the war, to the representation abroad of our military, naval and commercial interests.

Why the Paris Office of the N. A. C. A. was Established

When I went to Europe on June, 1919 for the purpose of carrying out the instructions specified above, our National Advisory Committee for Aeronautics was practically unknown there. At the present time, however, due to the important scientific research work done by this committee, and due to the great usefulness of its technical reports which are very generously distributed to people and organizations interested in aeronautics both in this country and abroad, (32,166 copies of these reports were distributed during the past year) our National Advisory Committee for Aeronautics is one of the most important aeronautical scientific organizations in the world.

My conception of co-operation between American and European scientists and technical men in advancing the knowledge of aeronautics through the promotion of a cordial exchange of scientific and technical data and thoughts, which had prompted me to suggest and which had led to the establishment of a foreign office of Aeronautic Intelligence of the N. A. C. A., was not always consistent with the limited functions which for a number of reasons had to be assigned by the N. A. C. A. to its Paris office.

After almost four years of efforts for bringing about, at least in aeronautics, a true spirit of international responsibility in the progress of science and a human feeling of personal responsibility among scientists and technical men of all nationalities in bringing about the desired results through co-operation, I feel more than ever that my point of view of what should have been the functions of the Aeronautic Intelligence Service of the N. A. C. A. was and is correct.

At the present time the functions of the Paris office of the N. A. C. A. are so defined in the eighth annual report of the committee:—

"To efficiently handle the work of securing and exchanging reports in foreign countries, the committee maintains a technical assistant in Europe, with headquarters in Paris. It is his duty to personally visit the Government and private laboratories, centers of aeronautical information, and private individuals in England, France, Italy, Germany, and Austria, and endeavor to secure for America not only printed matter which would in the ordinary course of events become available in this country, but more especially to secure advance information as to work in progress, and any technical data not prepared in printed form, and which would otherwise not reach this country."

Establishment of the Offices of Assistant Military and Naval Attaches in Charge of Aeronautics

The offices of Aeronautical Intelligence of the Army and Navy also maintain representatives of their own in Europe, officers of the Military and Naval air services, respectively, attached to the Staff of Military and Naval Attaches for the same purpose of obtaining reports and information on aeronautics in foreign countries.

The representative of the committee abroad is supposed to look after information of a technical nature only and is now supposed to apply for such information through the offices of Military and Naval Attaches whenever the source of information is under governmental control. When the Paris office of the N. A. C. A. was established in 1919 the Air service of the War and Navy Departments had no representatives of their own attached to the staff of Military and Naval Attaches and the representative of the N. A. C. A. abroad was directly in touch with Governmental Aeronautical Services and was officially accredited through our Ambassadors abroad to the various Air Ministries in Europe and through these to the various technical services under their control—likewise introduction to educational institutions not under the control of the War and Navy Departments were obtained through the Ministries of public education upon request of our Ambassadors.

Quite evidently this procedure immediately placed the European representative of the N. A. C. A. on such official status as to enable him to obtain for the Committee and for the War and Navy Departments any desired information on aeronautics which would have been proper for us to ask.

The program of cordial co-operation with European scientists and technical men adopted by the Committee was most sympathetically endorsed by Government officials and private individuals in Europe, and it is due to their fine spirit of co-operation in the development of such a program that I was able to transmit to the Committee in Washington during the two years that I was in charge of the Paris office of the N. A. C. A. 3,200 reports (most of them of a very confidential nature) and advance information about scientific research work either in progress or being planned for.

Government Officials and Private Individuals In Europe Eager to Co-operate with the N. A. C. A.

The work started by the N. A. C. A. in Europe, through its Paris office was looked upon as a continuation on a limited scale of the work done during the war by Scientific Attaches and the fact that the N. A. C. A. was a civilian organization not under the control of either the Navy or the War Departments, acting as a technical consulting committee responsible to the President of the United States and to Congress only, contributed a good deal to the establishment of cordial relations with European scientist and technical men who, in general, are not particularly keen about giving information to Army and Naval officers attached to the staff of Military and Naval Attaches.

For the same reasons aircraft manufacturers and inventors who would have not been willing to give information to our War and Navy departments which would have eventually reached our own aircraft manufacturers, their competitors, were quite willing to give information to the National Advisory Committee for Aeronautics upon the assurance on my part that information thus obtained would only be used by the Committee for technical research work, would not be divulged if so desired and that the Committee was ready to reciprocate the courtesy by exchanging information and technical data with them.

It is not surprising if under so many favorable conditions the establishment of the Paris office of the N. A. C. A. was a very successful undertaking—especially so it we consider that the office personnel that I engaged in Paris made up a most competent staff for our work which required technical knowledge of aeronautics and knowledge of languages. In fact we had as aerodynamical expert of our Paris office Mr. W. Margoulis, a former Director of the Eiffel Laboratory, and the combined knowledge of languages of our technical translators included: English, French, Italian, German, Spanish, Portuguese, Hungarian, Russian and Polish.

It is not surprising either that when later on military and naval officers, representing the Air Services of the War and Navy Departments respectively, were sent abroad as assistant military and naval attaches in charge of aeronautics, the Paris office of the N. A. C. A. was better equipped to obtain aeronautical information from both governmental and private sources of information than it was possible for them to do.

Monthly Technical Meetings at the Paris Office of the N.A.C.A.

In order to promote the spirit of cooperation between European and American scientists and technical men interested in aeronautics that I had been sent abroad for, we organized monthly meetings held in Paris for the purpose of discussing technical aeronautical problems of general interest. The importance of these meetings is proved by the attendance to them of Prof. Toussaint, director of the St. Cyr Aerodynamical Institute; Prof. Marchis of the University of Paris; Prof. Allard, technical director of the Belgium Air Service; Mr. Devillers, chief engineer of the Breguet works and formerly director of the Bureau of Standards S. T. Aè.; Dr. Garsaux, chief of the Physiological Department of the St. T. Aè,; Dr. Deschieu, technical advisor to the French Military Section of Aviation; Dr. Laprelle, Director of the Eiffel Laboratory; Mr. Gourdon and Mr. Leseurre, Directors of the Gourdon-Leseurre Works; Mr. Letang, Director of the Aviation Department of the Schneider Works; Mr. Vienart, metallurgical engineer of the Schneider works; Capt. Grimau, of the Experimental Division S. T. Aè; Capt. Lamè of the Motor Division S. T. Aè.; Capt. Huguet of the Airplane Division of S. T. Aè; and others.

At each meeting a paper was presented by one of the members and a very interesting discussion would follow. We had papers on wind tunnel design, on wind tunnel experimental work, on helicopters, on turbo-compressors, etc. A copy of the papers presented at our meetings and a resumé of the discussion was sent to the N. A. C. A. after each meeting.

These monthly meetings offered the unusual opportunity to the N. A. C. A. of being able to obtain the advice of the most distinguished aeronautical experts in Europe on any desired subject and in my estimation, it would have been very desirable, indeed, to organize in Paris subcommittees on aerodynamics, power plants for aircraft, and materials for aircraft, working in connection with similar subcommittees in Washington. I repeatedly made this suggestion to the N. A. C. A. which, however, for a number of reasons, has always been unable to take any action in this direction. As a matter of fact, these meetings could not even be held under the auspices of the N. A. C. A. They were held under the auspices of both Mr. Margoulis and myself but nevertheless were greatly appreciated by everybody concerned with them.

The Technical Review of Aeronautics Issued by the Paris Office of the N.A.C.A.

Considering the fact that most of the aeronautical reports originated in Europe were not written in the English language and could not be all translated by our office force in Paris, technical works appearing in new books, magazines, reports of engineering societies, unpublished reports of research laboratories, patents about new inventions, opinions, comments, suggestions and criticisms by eminent European aeronautical experts, designers and technical men on aeronautical problems were presented to the Committee in a monthly report issued by the Paris office of the N. A. C. A. under the title: "Review of Aeronautical Works".

Mr. W. Margoulis was in charge of the preparation of that review and it is due, both to him and the exceptionally good technical translators that we had, *all* the credit for the good work that we accomplished with that review. Also it was due to gratuitous and very kind collaboration of such men as Prof. Prandtl, Prof. Toussaint, Dr. Riabouchinski, Devillers, Rohbach and others if we were able to issue a review which has been highly complimented upon by competent judges of such a work both in this country and in Europe. Twelve numbers of this review were issued (some of the material contained in that review has since been published in book form by Mr. Margoulis) before we had to discontinue this work, due to the fact that we had to dispense with the services of Mr. Margoulis because he was not an American and the Committee, while it recognized that his services as aerodynamical expert of the Paris office were extremely valuable, "had to be careful in avoiding being criticized for employing foreigners instead of Americans". Also it seems that, for some reason or other, all technical work by the committee had to be originated in Washington and not elsewhere.

Duplication of the Efforts—Usefulness of the Paris Office of the N.A.C.A. Curtailed—

When assistant military and naval attaches in charge of aeronautics were sent abroad for the purpose of obtaining data and information on aeronautical developments for the offices of aeronautical intelligence of the War and Navy Departments, respectively, it was inevitable that their work should overlap and encroach upon the work done by the Paris office of the N. A. C. A. This state of affairs inevitably led to a duplication of efforts on the part of three agencies of the same Government independent one from another, all looking for the same sort of information. This situation soon became very annoying to all concerned and especially to foreign officials who were requested by three separate representatives of our Air Services (without counting the numerous representatives of one branch or another of our Government that are occasionally sent abroad on all sorts of missions requiring the investigation of matter already investigated by the N. A. C. A. and by military and naval attaches) to furnish over and over again the same information and the same reports.

In order to correct this situation something had to be done and the logical thing to do would have been to make some sort of arrangment whereby all aeronautical information of a technical nature should have been forwarded by aeronautical and military attaches to the Paris office of the N. A. C. A., and by this office to the committee in Washington and all requests for technical data and information on aeronautical developments in Europe as requested by the War, the Navy and any other department interested in aeronautics should have been forwarded to the Paris office of the N. A. C. A. If for some reason or other this could not have been accomplished, the next best thing to do would have been either to abolish the Paris office of the N. A. C. A. and let aeronautical and military attaches take care of both the military and technical end of the work, or else to place the Technical Assistant in Europe to the N. A. C. A. under the orders of Military and Naval attaches and let the Paris office of the N. A. C. A. be some sort of a subsidiary office helping them in all matters requiring the services of a technical staff which they do not have.

What was actually decided to do was this:—all requests of information desired by the N. A. C. A. had to be communicated by the European representative of the Committee to Military and Naval attaches and the desired information had to be applied for and had to be obtained through them whenever the source of information was under Government control. In other words Military and Naval attaches, or their assistants in charge of aeronautical matter, were supposed to hunt up information and reports for the Paris office of the N. A. C. A. (which, however, they never did while I was in charge of that office). All personal contacts between the representative of the N. A. C. A. and Government officials or aeronautical Governmental services had to be established through the offices of Military and Naval attaches which would make arrangements for the desired interviews.

Such an arrangement which finally superseded the previous arrangement whereby the European representative of the N. A. C. A. had been formally accredited to various European Governments by our Ambassadors as "a Government official representing the National Advisory Committee for Aeronautics, a technical Governmental Organization reporting directly to the Congress and to the President of the United States", changed quite some the standing of the Paris office of the N. A. C. A. and considerably curtailed the possibility of efficiently performing those functions which on May 1919 had furnished the reason for establishing that office.

The Importance of Technical and Research Work

The scientific research work done by the Committee since it was established, and especially during the last two years, has been of the highest order of excellence and has placed the N. A. C. A. in a well deserved position of leadership in aeronautics not only in this country but in the whole world. To increase the appropriation for the work of the N. A. C. A. to $1,000,000 per year would not be too much by any means if we stop to consider that no real progress can take place now in commercial aviation in this country, or in any other country, without giving the most generous support to research and development work which are the foundation of any safe and economical program of future developments in aerial transportation.

It is, I think, plainly understood by anybody who knows anything about aviation that commercial aircraft of the present day, due to their many technical limitations cannot become a factor in transportation until they reach such a stage of development that any man of ordinary intelligence and average physical qualifications can drive them safely. If we take into consideration that fact that it was only when automobiles in this country began to be numbered by millions that they became a factor in transportation, we are led to believe that even if we had 10.000 present day commercial aircraft in the air at any one time this would only mean an average of 60,000 passengers or 12,000 tons of freight being moved through the air at any one time.

It is through research and development work in aircraft, power plants for aircraft, materials and instruments for aircraft, that we shall be able to build sound commercial aircraft big and small which will not require any more intelligent driver than is required to-day for driving an automobile, car or truck, and that shall be just as safe. When we shall have reached that stage of development in aircraft design, aerial transportation will obtain the dignity of an essential industry, but not before.

The most crying need of aviation to-day is money for research and development work and this work is being taken care of very efficiently, indeed, by our National Advisory Committee for Aeronautics within the limited possibilities afforded by its budget.

At the same time, however, we have a right to ask that no money be spared for research work in aeronautics, we must insist on the adoption of a consistent program of expenditures and on co-operation between the various governmental agencies working on aeronautics.

We Need a Broader Control by the N.A.C.A. over Technical Aeronautical Matter

The National Advisory Committee for Aeronautics is responsible for most of the research work done in Aeronautics for the Government. Why should not this committee be in charge of all the work instead of being in charge of most of it? This, however we will discuss in another article.

The National Advisory Committee for Aeronautics is the officially designated depository for scientific and technical reports and data on aeronautics and maintains an office in Europe for the purpose of promptly obtaining these reports and data. Why should we need to have this work duplicated by and interfered with by the Army, Navy and all other departments interested in aeronautical developments in Europe?

Why can we not have one and only one office of Aeronautical Intelligence in Washington and one and only one branch of this office in every country where we are interested in following up aeronautical developments?

It is not with one technical assistant that the N. A. C. A. can be kept informed about what is taking place in Aeronautics all over Europe. It is not with the many limitations imposed upon the activities of its Paris office that the Committee can establish and promote a true spirit of international co-operation between governmental agencies, private concerns and individuals working on aeronautical, technical and scientific problems, both in this country and in Europe.

In a previous article, (AERIAL AGE December 1921), I have conclusively demonstrated, I think, that our National Advisory Committee for Aeronautics could greatly contribute to the advance of aeronautical scientific and technical knowledge in this country and in the rest of the world by taking the initiative in calling an international meeting of scientists and technical men interested in aeronautics for the purpose of reaching an agreement on a good many points demanding immediate action and cordial international co-operation.

I think I have proved that there is a demand from every quarter for such action as I have suggested and, furthermore, I think that I have proved that it is essential that any such action should be originated in the United States in order to be effective.

The point of view of the Committee on this subject, due to the stand taken by Congress on matters of foreign policy and for other reasons has been, so far, that "the committee has no right and no authority to call such a meeting".

I cannot see to-day any reason why the N. A. C. A. should not have the right and the authority to call such a meeting, and I cannot see any others than political reasons why the committee three years ago could not act upon the suggestion made at that time by its Paris office regarding the organization of technical sub-committees in Europe working in connection with the N. A. C. A. sub-committees in Washington and supplying to our Government the gratuitous advice of European experts on aeronautical, scientific and technical matters of mutual interest.

In my estimation the Aeronautic Intelligence Service of the Committee needs to be reorganized with a view of either properly utilizing the facilities offered by its Paris office in efficiently promoting that co-operation with European technical men which supplied the only reason for establishing it three and one half years ago or else it should be suppressed.

Why do We Not Restore the Offices of Scientific Attachés?

As a matter of fact why do we not restore once more the offices of Scientific Attachés to our Embassies in Europe? Are we not interested in scientific developments in Europe at least as much as we are interested in commercial, military and naval developments?

Scientific Attachés reporting to the Department of Commerce, same as Commercial Attachés, would be a very useful and timely addition to the official diplomatic family of our Ambassadors abroad.

Attached to the offices of Scientific Attachés a technical assistant to the National Advisory Committee for Aeronautics with the official title of Assistant Scientific Attache in charge of aeronautics, could perform some very good work for the Committee and for aeronautics. Especially so when a much needed Bureau of Civil Aeronautics organized under the Department of Commerce shall be created.

What we need, what the world needs, is co-operation. What aeronautics needs most is the co-operation of scientists, technical and business men of the world in the solution of present day aeronautical problems, and less, a good deal less of the military control now prevailing on every phase of development of aviation in every country.

Military and commercial aviation have no points of contact whatsoever—their problems of design, construction and operation are entirely separate, and to permeate any program of commercial aviation in this country with military and naval points of view having in mind the eventual use of commercial aircraft for offensive or defensive operations in case of war, will lead us to the same impasse which has been reached in Europe, where the failure of commercial air lines to pay even a part of their operating expenses is mainly due to the type of aircraft used, which are not well suited to the kind of service required of them.

The criticisms passed upon the present organization of the two or three Aeronautical Intelligence Services which are all trying to the best of their ability to advance the progress of aeronautics without however a great co-ordination of efforts, have been made in a constructive spirit of co-operation and the suggestions accompanying them are offered for what they are worth to those who are interested in government efficiency.

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The National Aeronautic Association

THE National Aeronautic Association, in the few months of its existence, has done notable work in focussing the attention of the entire American public on the subject of aeronautics. The special National Aeronautic Association issues of *U. S. Air Service* and *Aeronautical Digest* bore testimony to the fact that outstanding figures in the business world in America are beginning to think aeronautically, and the newspapers throughout the country have been quick to recognize this fact, with the result that the newspaper press have published during the past few months a vast amount of constructive aeronautical material.

It is the privilege of AERIAL AGE this month to continue this great work. The articles which this issue contains will do much to still further public interest, and more, it will carry the story of American aeronautic unity and development to the furthermost countries of earth, for today there is not a country in the world that does not have a subscriber on the lists of this publication.

The National Aeronautic Association is to be congratulated on the excellent work that it is doing, and every reader of AERIAL AGE should endorse this good work by signing and returning the membership application blank to be found on another page in this issue.

Commercial Aeronautics

WE are privileged in being able to present the views of one of America's leading aeroplane designers on the Paris Aero Salon, and it is gratifying to have Mr. Loening assure us that America is holding its own, and a little more, in the matter of design refinement looking towards the day when commercial aeronautics will have found its established place in the world's modes of transport.

It is to be hoped that the forthcoming summer will see greater activity in commercial aeronautics in this country than we have hitherto had. The public is ready to be shown, and it is to be hoped that the manufacturers will show greater faith in their own product than they have done up to the present, by starting air lines through which the public can be educated to air travel.

Manufacturers of aircraft are naturally in the best position to start air line development, but there has been an amazing lack of interest in this phase of aeronautics by the American manufacturer. Practically every air line venture in this country has been started by men who were entirely, or almost entirely, devoid of manufacturing and designing knowledge. The results of these ventures we are all aware of.

The executive of an automobile factory would hardly think of taking a trolley car for a short journey. Road travel to him means automobile travel. So should it be with the aircraft executive. If these executives would travel by the air route occasionally—and preferably all the time—they would find that it would greatly increase their aeronautic enthusiasm, and if their mission should happen to be to Washington on aeronautic appropriations, it is reasonable to assume that worthy members of appropriation committees would be more impressed if the aircraft executive could preface his remarks with "I have just flown over from New York to talk over this matter with you".

This seems to be one of our biggest handicaps; our aircraft executives are not practically sold on their own mode of transportation, or at least if they are sold, they rarely utilize the air mode of travel.

American aircraft made an enviable record last year. Let us hope that our commercial record this year will be equally notable.

Standardization

FROM every country in the world where aeronautics is receiving scientific consideration, AERIAL AGE has received letters of commendation from the leading aeronautic engineers and designers on the series of articles which we have published from the pen of William Knight, M. E. We have provided an opportunity for the expression of ideas, and our readers know that full advantage has been taken of this opportunity. An international conference should be called to consider the very important subject of standardization, and this conference should be called by an American organization. It is well within the scope of the National Aeronautic Association to take a position of international leadership in the matter, and it is to be hoped that President Howard E. Coffin, who is now investigating the subject in Europe at our suggestion, will come back with a cordial recommendation that the N. A. A. go ahead with the conference.

Air Warfare Regulation

IN the last issue of AERIAL AGE in an article on "The International Aeronautic Foundation" by William Knight we pointed out the desirability of starting a world wide movement for the creation of a powerful moral force condemning the use of aircraft in time of war against defenseless cities far behind the zone of operation of the armies, for the purpose of demoralizing the armies at the front by killing the women and the children of the cities at the rear of the battlefields.

AERIAL AGE, as far as we know, was the first aeronautical magazine to raise this point, and therefore we feel greatly grateful in seeing that our suggestions, which were transmitted to the Hague Tribunal, have been incorporated in the recommendations made by the jurists commission appointed to discuss the rules of war according to the resolution adopted at the Washington conference.

Howard E. Coffin, Pres. B. H. Mulvihill, V. Pres. **Official Bulletin of National Aeronautic Association of U. S. A.** B. F. Castle, Treas. John B. Coleman, Rec. Sec.

Col. H. E. Hartney, General Manager Cable Address, Nataero National Headquarters, 26 Jackson Place, Washington, D. C.

The National Aeronautic Association of U. S. A. assumes responsibility for the statements under this heading

DURING the past month, the activities of the Association have been along constructive lines and several particularly important events have taken place which contribute to the growing history of aeronautical development in this country and throughout the world.

The Federation Aeronautique Internationale

The National Aeronautic Association of U. S. A. is now the sole American representative of the F. A. I., and in the future, all contests, flights for records, sports, and meets in this country, in order to be homologated for purposes of world's records, must be under the rules and regulations of the Association by virtue of its affiliation with the Federation Aeronautique Internationale.

Under the F. A. I., the Association appoints Committees responsible for the enforcement of the rules of the Federation, issues licenses to pilots, and for meets and races; sanctions meets, races and sports; classifies aircraft; examines and passes on regulations and programs for contests; ratifies results; may bar suspended persons from participating in events; passes upon the advisibility of events; designates approval of officials and appoints timekeepers; gives official ratification to records and imposes penalties; pronounces the homologation of international events, and gives final decisions as to international records.

Pulitzer Races at St. Louis

The Contest Committee in concurrence with the Army and Navy Air Services, has selected St. Louis as the place where the Pulitzer Cup Races for 1923 will be held. St. Louis appeared to be the most suitable location for the Races, under the new conditions and regulations imposed by the F. A. I. In connection with the Pulitzer Races will be held the Annual Convention of the Association and the Second Air Congress, in conjunction with the Aeronautical Chamber of Commerce, the National Advisory Committee for Aeronautics, the Society of Automotive Engineers, and kindred bodies.

The Contest Committee is now consulting with aircraft manufacturers and Army and Navy officials regarding the details of the Pulitzer Races in order that a larger number of contestants may enter these races than participated last year when the details of the races were not decided upon until very late in the season. It is anticipated that a number of foreign contestants will be present from Great Britain, France, Belgium and Italy.

Collier Trophy

The Collier Trophy Committee, a subcommittee of the National Contest Committee, with Lieut. Colonel Frank P. Lahm, U. S. A., Porter H. Adams, Vice President and Governor First District, George W. Lewis, E. E., Executive Officer of the National Advisory Committee for Aeronautics, Chairman, and B. Russell Shaw of National Headquarters as Secretary, awarded the Collier Flying Trophy for the greatest achievement demonstrated in the actual use of aviation in 1922, to the personnel of the Air Mail Service.

In connection with this award the Committee stated that: "The wonderful achievements of the Air Mail Service in completing a year's operation along the different routes from coast to coast and in all conditions of weather without a single fatal accident, is, in the Committee's opinion, the greatest achievement in aviation made in the past year. This performance denoted substantial progress in the practical application of airplanes to the purposes of commerce and other peaceful pursuits. This excellent performance has been attained through the development of an inspection and operating system, by the Air Mail Service, which made possible the most successful demonstration of the practical application of airplanes for commercial purposes."

Accordingly, on Monday, February 5th, 1923, Dr. George W. Lewis, Chairman of the Committee, flew from New York in an Army Mail plane, piloted by Harold T. Lewis, Air Mail Pilot, having in custody the Collier Trophy, and landed at Bolling Field, Washington, D. C., where the ceremony of presentation was carried out. The presentation speech was made by Dr. Lewis for the Association and the Committee and the speech of acceptance, by Postmaster General Hubert Work, as representative of the Air Mail Personnel.

Among those present at the exercises were First Assistant Postmaster General John H. Bartlett; Second Assistant Postmaster General Colonel Paul Henderson, in charge of Air Mail; Third Assistant Postmaster General Warren L. Glover; Fourth Assistant Postmaster General Harry H. Billany; Carl F. Egge, General Superintendent of Air Mail; and a large staff of superintendents and air mail pilots; Admiral Wm. A. Moffett, Chief of the Bureau of Aeronautics of the Navy; General Mason M. Patrick, Chief of the Army Air Service, officers of the Army and the Navy Air Services, and officers and members of the National Aeronautic Association.

Mackay Army Trophy

The Contest Committee, in concurrence with the Army and Navy Air Services, Chief of the Army Air Service, and with the approval of the Board of Governors of the Association, sanctioned the award of the Mackay Army Trophy to Lieutenants John A. MacReady and Oakley G. Kelly, for the most outstanding flight of the year, 1922, it being an endurance flight when these two pilots stayed in the air 35 hours and 18 minutes. The trophy is an immense silver cup presented by Mr. Clarence Mackay to be competed for annually by officers of the U. S. Army, under rules to be made each year by the War Department, or, in the absence of a contest, to be awarded annually by the War Department to the officer or officers who make the most meritorious flight of the year.

Mr. Coffin Goes to Rome

One of the most important missions from the United States to Europe since the War is that of the delegates of the International Chamber of Commerce, who sailed on February 10th for Rome. Mr. Howard E. Coffin, President of the National Aeronautic Association, with Colonel Harold E. Hartney of National Headquarters, as his aid, are among the officials attending the Congress. For the first time in the history of international commerce conferences, aeronautics is to be represented by officials of a national aeronautic association. Mr. Coffin as the delegate of the National Aeronautic Association, and a member of the Air Transportation Group in Rome, will represent the expanding interests of aviation in the United States. Mr. Coffin and Colonel Hartney will further consult with officials of the F. A. I. at Paris and leaders in aviation in England, France, Italy and Spain regarding projected contests, air meets, and sports in the United States with the expectation that foreign entrants will be secured.

Honorary Membership to Mr. Edison

On February 12th, 1923, honorary membership in the National Aeronautic Association of U. S. A. was conferred upon Thomas A. Edison, on the occasion of his 76th birthday. Presentation of the parchment certificate of honorary membership was made by Dr. Michael I. Pupin, of Columbia University, formerly a member of the National Advisory Committee for Aeronautics. From National Headquarters, Vice President B. H. Mulvihill, and Director of Information, C. A. Tinker, were present at the ceremonies, which took place at the Edison Plant at East Orange, N. J.

Gliding Contests

The Committe on Gliding and Soaring Flights, of which Orville Wright is Chairman, has sent out questionnaires to the mayors of the cities and towns throughout the country together with the requirements of terrain necessary for holding glider contests, in an effort to secure information to enable them to decide where glider meets may be held in this country. At the same time, arrangements are being made to carry out gliding contests early in the coming season, with the expectation that Maynerolle and other expert gliding pilots from Europe will participate.

Meeting of the Board of Governors

The second meeting of the Board of Governors of the Association was held on January 25th, 1923, at the Racquet Club, Washington, D. C. Vacancies on the Board of Governors were filled by the election of Vincent Astor and Marshall Field Jr., of the Second District, and Charles A. Moffett, of Birmingham, Alabama, Fourth District.

A change in the by-laws, paragraph 10, article 11, under heading "Objects of Incorporation" was voted upon and the following clause added: "To supervise, control, and as far as possible, encourage, direct and advise, with reference to the sport of flying and the use of air machines to the end that such sport may be so conducted and so employed as to advance the art of flying, the science of aerial navigation, and the production of aircraft".

The following resolution was unanimously carried upon the announcement by Porter H. Adams, Vice President and Governor of the First District, that Captain Henry C. Mustin, Assistant Chief of the Bureau of Aeronautics of the Navy Department, was seriously ill at the Naval Hospital at Washington: "That a letter expressing the regrets and sympathy of this body be sent to Mrs. Mustin." This resolution was carried out.

THE NEWS of THE MONTH

Air Traffic Rules Agreed On

The section of the Aeronautical Safety Code which deals with air traffic and pilotage rules is now practically complete. Other sections of the code are nearing completion and it is hoped to have the codes ready for promulgation within the year. This code is being developed by a committee gotten up by the Bureau of Standards and the Society of Automotive Engineers, and including experts from the Army and Navy air services, the National Aeronautic Association, the Aeronautical Chamber of Commerce, and all other groups of men who are interested in air craft. Its object is to provide a uniform and well considered code of rules for the construction, maintenance, and operation of aircraft, and to serve as a guide for government regulation.

According to the traffic rules adopted airplanes on landing fields, or airdromes, have all right of way over all other traffic. Pedestrians and vehicles are not permitted on these fields except in the discharge of some duty connected with airplanes, and even then they are required to keep out of the way. An exception is made in the case of some particular area of the field which for purposes of repairs may be marked by red flags or lanterns as not in use.

Airplanes landing have right of way over airplanes taking off, both have right of way over airplanes taxiing along the ground, and a machine in distress, on fire, or with a dead engine, has right of way over everything else.

Seaplanes maneuvering on the water under their own power are subject to the same traffic rules as power vessels, and in landing or taking off they must give right of way to surface craft.

The rules in the air are similar to those at sea, with the exception that in addition to turning to the right when meeting, the higher of the two machines may rise, and the lower may dive, but they must not pass by rising and diving only. A machine overtaking another from behind must pass to the right the same as at sea.

As between different types of craft the less maneuverable has right of way. Thus airships have right of way over airplanes; balloons, captive or free, have right of way over both. Formations of several machines travelling together have right of way over single airplanes but do not have right of way over airships. An airship not under control of its own power and displaying two black balls hung in a vertical line, or two red lanterns, shall be considered as a balloon and given right of way as such.

The regulations also provide for the safety of persons on the ground. Nothing may be dropped while in flight except ballast, and this ballast must consist of water or fine sand arranged to be dropped loose. An exception is made in the case of certain restricted areas where cargo attached to a parachute may be dropped. Stunt or trick flying is prohibited over built-up areas, near airdromes, or anywhere else where it is likely to endanger others than the participants.

The altitudes at which built-up areas may be crossed are specified, these being governed by the width of the area and being so chosen that in case of engine trouble a machine will be able to land in an open area, such as park or river where its fall will not endanger persons or property on the ground. Landing in public highways or other areas not expressly reserved for the purpose is prohibited except in emergency, and then the landing plane must give right of way to everything else.

Other provisions of the code deal with the maneuvering of airplanes in the vicinity of airdromes, and the starting of their engines. The latter part is still unsettled. The signals in use in the United States differ in some slight respects from those in use in other countries, and it is hoped to get them more nearly alike in order to prevent danger of misunderstanding when an American plane lands in Canada or a Canadian plane lands on this side of the line.

Rules providing for the use of airways are included. These are lines over which air traffic regularly passes and will be equipped with regular and emergency landing fields at suitable intervals. A pilot leaving an airdrome for a cross country flight is required to notify the commander of the airdrome of his intended destination. This makes it possible to send out and look for him in case he does not arrive. He is also required to inform himself of the weather conditions at the other end of his journey.

Aviation Site to Seattle

The Navy Department has leased Sand Point on Lake Washington, near Seattle; and, according to reports, will soon establish an airdrome there. While Seattle has held an important place in the industry, because the big plant of the Boeing Airplane Company is located there, the city has never had a landing field. Residents of Seattle are looking forward to the completion of the Sand Point project, which they hope will develop into a public airdrome.

Bureau of Standards Publishes Bibliography of Scientific Literature on Helium

Absolutely non-inflammable, yet with nearly as much lifting power as hydrogen, helium, the new balloon gas, constitutes one of the most spectacular scientific achievements of the generation, and its production on a commercial scale is a subject of the greatest interest to aeronautics.

It was discovered in the atmosphere of the sun before it was known to exist on earth, and was later found to exist in minute quantities in the air, from which it was produced at a cost of $1,700 per cubic foot. During the war it was found to exist in much larger quantities in certain American natural gases from which it is now produced at a cost low enough to permit its use in balloons. This is done by cooling the gas to within a few degrees of absolute zero, at which temperature everything becomes a liquid or a solid except the helium.

A large amount of scientific literature has been written about helium. With a view to making this literature more available to those who are interested in it, the Bureau of Standards of the Department of Commerce has issued a circular giving a list of all this literature. It is Circular No. 81, entitled "Bibliography of Scientific Literature Relating to Helium," and may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5 cents a copy.

About 600 publications are listed, and they are so arranged under various headings that the reader may easily follow the historical development of any branch of the subject in which he is interested.

Air Mail Act

On Jan. 16, the Steenerson bill (H. R.11193) with amendments was reported out and committed to the Committee of the whole House (Rept. 1421). The bill as it now stands is as follows:

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled. That this Act may be cited as The Air Mail Act.

Sec. 2. That when used in this Act the term "air mail" means first-class mail prepaid at the rates of postage herein prescribed.

Sec. 3. That the rates of postage on air mail shall be not less than 8 cents for each ounce or fraction thereof.

Sec. 4. That the Postmaster General is authorized to contract with any individual, firm, or corporation for the transportation of air mail by aircraft between such points as he may designate at a rate not exceeding 2 mills per pound per mile, and to further contract for the transportation by aircraft of first-class mail other than air mail at a rate not exceeding one-half of a mill per pound per mile.

Sec. 5. That the Postmaster General may make such rules, regulations, and orders as may be necessary to carry out the provisions of this Act: Provided, That nothing in this Act shall be construed to interfere with the postage charged or to be charged on Government operated air mail routes.

The rate proposed in the Steenerson bill just reported, of one-half mill per pound per mile is satisfactory to airship interests providing there are enough pounds to be carried. There should be at least 20 or 25 thousand pounds available. A third of the daily first class mail between New York and Chicago, for instance, would enable an airship company to operate profitably. Airship mail would to a large extent take the place of night letters by wire at a cost of but 8 cents a letter, with 10 cents for special delivery. The air mail would leave either terminal at the end of the day, hours after the 18-hour trains have left. From Chicago to points like St. Paul and St. Louis the mail would be taken by airplane. It is inconceivable that citizens of cities like these would wait until the morning of the following day for the mail that they knew was already in Chicago and a demand for airplane mail for the shorter hauls would be immediate. The airplane operators would naturally depend upon express and package deliveries at higher rates to add sufficiently to the income to make the routes possible.

It is admitted that this air mail to Chicago under the Steenerson bill would be about three times as costly as train transportation, but it is considered the saving in time is worth it. There is, of course, a saving in the reduction of the number of mail cars.

Figuring the New York-Chicago distance as 715 miles, at .5 mill per pound per mile the payment to the transportation line would be $35.75 for a pound. An airplane carrying 500 lbs. only would receive for the trip $178.75 at this rate.

It is obvious that any line operating airplanes would have to have planes carrying 1250 to 1500 pounds of mail in order to approximate costs—and there is not a plane in this country suitable for this work, far as known, with an engine that is economical in gasoline consumption.

Post Office figures show a cost of $1.93 per mile, including all overhead of every kind, buildings and construction; and it is likely a civilian operating company would be able to materially reduce this figure. Night flying is, of course, essential.

It is possible the public can be brought to realize the advantage of insurance of speed by putting on the 8 cent stamp, in which case the income on mail so stamped raises to 2 mills per pound per mile, or $1.43 for a pound of mail from New York to Chicago, or $715 for a 500-pound load.

That the public may be educated to this is a question. When a special rate was made for air mail between Washington and New York the purchases of these special stamps gradually dwindled to but one hundred a day. When the Cleveland-Chicago air mail route was opened up, it was possible to mail an order from one city in the morning by special delivery and get the goods in the afternoon of the same day. Merchants made a feature of this, displayed these round trip letters in their windows and advertised shoes that had been delivered before sunset. It may be possible for the various organizations interested in aeronautics to educate business to an appreciation of the returns on the added investment in postage.

ARMY and NAVY AERONAUTICS

McCook Field's Helicopter Gets Off

The 18th of December has been marked in red on the McCook Field calendar in commemoration of the first take-off of the Army Air Service helicopter, designed by C. de Bothezat. On this day, piloted by Major T. H. Bane, former head of McCook Field, it made a duration record of 1 minute 48 seconds. On Jan. 19, for what is said to be the first time in history, Bane and the veteran old time night flyer Art Smith made several ascensions.

The machine is in the form of a four-arm spider mounted on a four-wheel chassis. At the extremity of each arm is a 6-bladed air screw, with the blades adjustable as to pitch, driven by shafts through rack and pinion by a specially re-built 170 h. p. Le Rhone engine. The air screw speed is judged to be about 60-70 r.p.m. In flight the machine has a pendulum action which will doubtless be corrected, if possible.

The machine rose straight from the ground, hovered and then descended easily. The machine has a weight of 3600 lbs., pilot and fuel included.

In the picture will be noted the rope altimeter. Whether this is the invention of the eminent Bothezat or the equally eminent army officer, an exhaustive investigation failed to disclose. This is knotted at intervals. When the last knot is off the ground the altitude is known by direct reading, no triangulation being necessary. Rumors to the effect that Bane would go after the altitude record were considered by experts to be premature.

However, the machine has great possibilities, though as a freight carrier no bootlegger would even consider it. If the Germans had had machines like this in place of observation balloons, Frank Luke would sure have been out of luck.

The National Guard in Aviation

Seven of the eighteen divisional air service units of the National Guard authorized by the General Staff are now in operation and it is hoped the balance will be going squadrons by June 30th, 1924. These seven are as follows:

Alabama—135th Observation Sqdn., Birmingham
Indiana—113th Observation Sqdn., Kokomo
Maryland—104th Observation Sqdn., 104th Photo Sec., and 104th Air Intelligence Sec.
Mass.—101st Observation Sqdn., East Boston
Minn.—109th Observation Sqdn., Photo Sec. and A. I. S., St Paul
New York—102nd Observation Sqdn., Photo Sec. and A. I. S., Staten Island
Tenn.—136th Observation Sqdn., Nashville

During the next six months it is hoped organization will have been completed of observation squadrons in the states of Pennsylvania and Ohio.

All equipment in the way of airplanes, and accessories are obtainable as free issue from the Army Air Service, after such material has been declared surplus. The planes are JN4Hs and JN6Hs. The Regular Army flight instructor on duty with each outfit has a DH4B for his own use.

The seven squadrons already organized participate regularly in flying, in spite of the fact that they draw no flying pay. Legislation is now up to give them increase when on flying status.

The nucleus of each squadron is comprised of officers who have had world war service as pilots or observers. For replacements there are three pools: first, from the school now being conducted at Brooks Field of four months' duration, at which non-flying officers who are members of these squadrons receive instruction which will qualify them as junior airplane pilots—there are 12 now at this school; second, the Chief of Air Service has arranged to allow two or three enlisted men from each National Guard squadron to taek the regular cadet course each year; third, any man who has been unable to qualify at a service school but who has done considerable commercial flying is allowed to take an examination both in flying and in Air Service subjects, upon the satisfactory completion of which he becomes a junior airplane pilot if he can pass the same

The De Bothezat Helicopter

medical examination as regular army flyers.

The equipment furnished each squadron from the Air Service free, include airplanes, spares, flying clothing, etc. Freight is paid by the Militia Bureau. The State must furnish a suitable flying field, buildings except hangars, such as machine shops, and tanks for oil, gas and water. The Militia Bureau furnishes oil and gas.

The cost to the State to maintain an observation squadron is rather large and some states are loathe to spend the money but where the squadrons have actually gone into operation the states have considered the money well invested.

The investment in such a squadron is of interest. Following are round figures:

Initial equipment, airplanes, hangars, clothing accessories	$169,500
Flying clothing	2,660
Other technical equipment	38,000
Furnished as free issue through Air Service....	210,160
Estimated upkeep, one year, replacing planes and repairs, paid by Militia Bureau	50,000
Labor, oil, gas, paid by Militia Bureau	12,319

Cost of everything else, such as shed floors, upkeep of the field, machine shops, other sheds, etc., is borne by the State.

New Airplanes for the Primary Flying School

Forty new airplanes have been allotted to the Air Service Primary Flying School, Brooks Field, San Antonio, Texas. These new ships will be delivered within the next three months, and include the followingg; Twenty VE7, nine TA-3, one TW-3 and ten SE5A. The VE7 will be used for dual instructing, and a test will be made to determine the relative value of this type of plane over the JN's, the present type of a plane used for dual instructing. The same test will be made with the nine TA-3, a 2-seater training airplane with the 110 h.p. LeRhone engine. It is a single bay, externally braced biplane, stick and wire construction of wings, with a welded steel fuselage. The cockpit provides for two men, side by side, with dual controls. The TW-3 is substantially the same airplane, except that the crew is further back, thus improving vision, and the 180 h.p. Wright engine is installed.

New Type of Spherical Balloon

A new type of spherical balloon has been developed by Messrs. M. Q. Corbett, William E. Huffman and C. F. Adams, of the Lighter-than-Air Section, Engineering Division, McCook Field, Dayton, Ohio. All of the development work connected with this new balloon was carried on by the designers outside of their regular duty hours, and the expense incurred was also borne by them. A patentable interest in the use of this invention for military purposes has, however, been tendered to the Government.

The novel feature of this balloon is a new and third method of control, which consists of a propeller revolved by a rope belt within convenient reach of the pilot. Pulling the right hand side of the belt causes the balloon to ascend. The reverse causes a descent. The gas bag has a capacity of 5,000 cubic feet, and is equipped with a gas valve and rip panel, as is the usual practice in spherical balloon construction. The weight of the entire equipment, including bag, rigging, basket and propeller mechanism, is only 125 pounds. It can be folded into a small enough bundle to be conveniently carried in a Ford car. Flights of three hours' duration have been made with this equipment by a 186-pound man without using the gas valve and during which only one bag of ballast was expended.

This balloon has been undergoing extensive tests in the vicinity of Dayton, making both day and night flights. With this new feature of control it has been found possible to make a quick get-away from most any location without the necessity of weighing off dangerously light, as with its propeller equipment, which can be made to give a vertical thrust of five pounds either ascending or descending, this small craft is especially suited for making ascensions from grounds surrounded by buildings or other obstructions.

The object in bringing out this special piece of lighter-than-air equipment is an attempt to fulfill a military need for a small and inexpensive balloon to give training to students in ballooning and parachute jumping, and to provide an economical means for testing newly developed meteorological instruments.

Parachute landings can easily be simulated with this equipment by using a regular parachute harness and controlling the descent by the use of the propeller, which involves the same principle as the gradual application of the brakes of a motor vehicle going down a steep grade.

Some of the tests which have been conducted with this new equipment include the following:

1. Holding an altitude of 1,000 feet for forty minutes without ballast, using the propeller only to compensate for changes in gas volume.

2. Landing from an altitude of 3,000 feet under unstable conditions without using valve or ballast, using the propeller control only.

3. Making ascensions from grounds immediately surrounded by buildings, smoke stacks, and other obstructions, using the propeller mechanism to facilitate a rapid rise above these obstructions.

4. Making a flight of six hours' duration during which time five landings were made and each time pilots changed, two of the pilots being men who had never before handled a balloon.

5. Jumping, slightly heavy, to altitudes of as much as 150 feet, using the propeller to aid the jumping effect, and then as a brake in regulating the landing speed.

Construction of an Auxiliary Airship Hangar at Scott Field

Work has been started on an auxiliary airship hangar at Scott Field, Belleville, Ill., located adjacent to the northwest corner of the large airship hangar recently put into service. The new building, which will cost $18,000 and is being constructed by the W. S. Rae Construction Co. of Pittsburgh, Pa., will be a steel frame structure with asbestos siding. It will be 75 feet wide, 120 feet long, and 57 feet high, and will be used for the construction and repair of large airship parts.

National Guard Officers Arrive at Brooks Field for Training

The following-named National Guard officers reported to Brooks Field, San Antonio, Texas, for primary flying training:

Captain Benjamin R. Jacobi and 1st Lieut. Raphael R. Dieden from Indiana; 1st Lieuts. Joe F. Westover, Ralph F. Jerome and 2nd Lieut. John J. Hinkens from Minnesota; 2nd Lieuts. William N. Finley, Obe W. Carman and Edwin C. Brockenbough from Maryland, and 2nd Lieut. Joseph K. Barber from Massachusetts.

Many of these officers were in the Air Service during the World War, and in their cases their flying instruction will be in the nature of refresher training. The remainder of these officers will take the regular flying course in the morning and ground school instruction in the afternoon.

World Almanac Publishes Model Aeroplane Records

The World Almanac for 1923 appears to be the first book of its kind to publish among various world's aeroplane records, an up-to-date list of model records. This list appeared in Aerial Age several months ago. The recognition of model flying as a scientific sport should help to further the art of model building to a great extent. A great number of young men have felt that the flying of model aeroplanes was too juvenile for them to continue after leaving public school. Yet we see that a great many ex-model fliers are now engaged in the aircraft industry, many of them pilots, principally because of their continued experiment and interest in models.

Much is to be learned from models. Of course they can never take the place of the study of full sized planes, but in the absence of inaccessibility of the latter, they demonstrate the identical scientific principles as found in man-carrying aeroplanes. And there is no doubt of the fact that there is a fascination about them which holds the interest and instructs at the same time.

Let us keep up our interest and development of model flying, continuing it in the dignified manner which has quietly placed it on the list of recognized scientific sporting events.

Flying With Low Horsepower

A man-carrying aeroplane has actually flown with a four H. P. engine. And this was accomplished thirteen years ago. Mr. M. B. Sellers in 1910 at Grahn, Kentucky, designed and built a small 4-winged aeroplane of unusually light construction with which successful flights were made. A Dutheil & Chamers opposed two-cylinder engine of 4 brake horsepower was used. Six one-quarter inch auxiliary exhaust holes were bored in each cylinder which increased the actual horsepower about 15 per cent.

Later flights were made with the same machine, using a specially built 10 H. P. Bates engine. Wheels and skids were used for the landing gear. The flights were reported as not merely "hops" but the machine was capable of remaining in the air for extended periods, being entirely controllable and stable.

From these experiments is it reasonable to expect much from the idea of providing the present-day gliders or soaring machines with an auxiliary power plant of low power. This will allow of prolonged soaring flights, as the power could be put to work only when meeting adverse winds, thereby extending a soaring flight which would otherwise terminate upon meeting unfavorable down-currents in certain localities passed over. The economy of operation for an air vehicle of this nature is so obvious that advances are sure to be made along these lines in a very short time. The problem of the low-powered gliding machine has occupied the attention of many well-known engineers, but so far no real demonstrations have been made.

Little power is required to sustain a light machine in the air; a great deal more power is required to get a machine off the ground than to keep it there. The ratio of power to get a seaplane or flying boat off the water is even greater than in the case of a land machine, in relation to the power necessary for flight. This accounts for a great measure of the flying-boat's safety, for when a boat can rise from the water it has ample reserve power to prevent stalling. On the other hand, a land machine can get off the ground with too little reserve power and a slight falling off of power gives insufficient lift.

By means of an effective launching device, by hand-launching or by taking off from a steeply inclined surface, the low-powered gliding or soaring machine may prove to be not only an inexpensive sport machine but may develop into a commercial vehicle of great importance.

Aeronautic Instrument Problems

One of the most important of the outstanding problems in the field of aeronautic instruments at present relates to the development of navigating instruments for use in long distance flights and for flying at night and landing in fog. These include not only development of optical instruments used in connection with astronomical position finding but also improvements in altimeter, compass and turn indicator construction.

There is also reason to believe that commercial flying may soon be undertaken at very high altitudes to take advantage of favorable winds of high velocity. In this connection the importance of oxygen instruments will unquestionably be emphasized. The extensive use of large aircraft, particularly of lighter-than-air craft, requires the development of satisfactory distant-reading instruments of various types. The proposed methods applicable to distant reading compasses, air-speed indicators, tachometers and thermometers, discussed in Report No. 132 of the National Advisory Committee for Aeronautics, are still in a preliminary state and have not been extensively used in practice.

The development of greater precision in all of the aeronautic instruments should be attained. While errors of from 1 to 5 per cent which are now common in instruments as actually installed in aeroplanes are not fatal under ordinary circumstances, such errors are much greater than could be desired. In certain instruments, particularly those used in navigation and in landing, errors of this magnitude constitute a serious if not fatal defect. Moreover, under certain special conditions, for instance, in aircraft performance tests, it is essential that the instruments have the greatest accuracy obtainable.

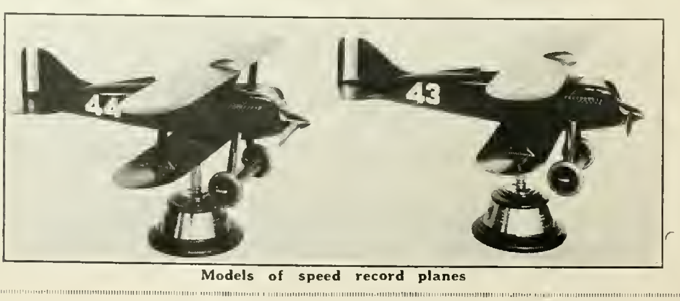
Models of Speed Record Planes Presented to Pilots

As souvenirs of their record speed flights at Detroit last October, the pilots of the first two aeroplanes to finish in the Pulitzer Trophy Race, Lieut. R. L. Maughan and Lieut. L. J. Maitland have been presented by the Curtiss Company with accurate scale models of the aeroplanes in which their records were made.

The Curtiss-Army racers proved to be the fastest aeroplanes in the world. In the race, speeds of 205.5 and 198.8 miles an hour were attained. After the race, Lieut. Maughan flew his machine at the rate of 232.2 miles an hour in a test flight conducted by the U. S. Army Air Service. This same machine was later flown by Brig. General Wm. Mitchell at the rate of 224 miles an hour in an Internationally recognized official flight.

The models are accurately made to the scale of one inch to the foot and measure 19 inches across the wing span. They do not vary in any dimension more than one-thousandth of an inch from true scale proportions of the real machine. The wings, propeller and tail surfaces are finished in gold. The body and other structure is of ebony. The regulation red, white and blue insignia are painted with inlaid enamel coloring. Gold name plates mounted on the ebony bases are inscribed with the pilot's names and a notation of the speeds they attained.

An interesting feature connected with these models is the fact that they are the original "wind-tunnel" models from which the successful racers were developed. These models, made by Mr. T. H. Birmingham, model maker for the Curtiss wind-tunnel, were tested before the race to determine the characteristics of the full sized aeroplanes then only in the first stages of design. By their use, the speed and other useful data are determined before the real machines are built. Minor adjustments and alterations of the original design are made to conform to the information thus obtained. Their original purpose having been served, the Curtiss model-maker converted the models to their present ornamental form. Therefore they have not only a novel and highly artistic value but an interesting historical value as well.



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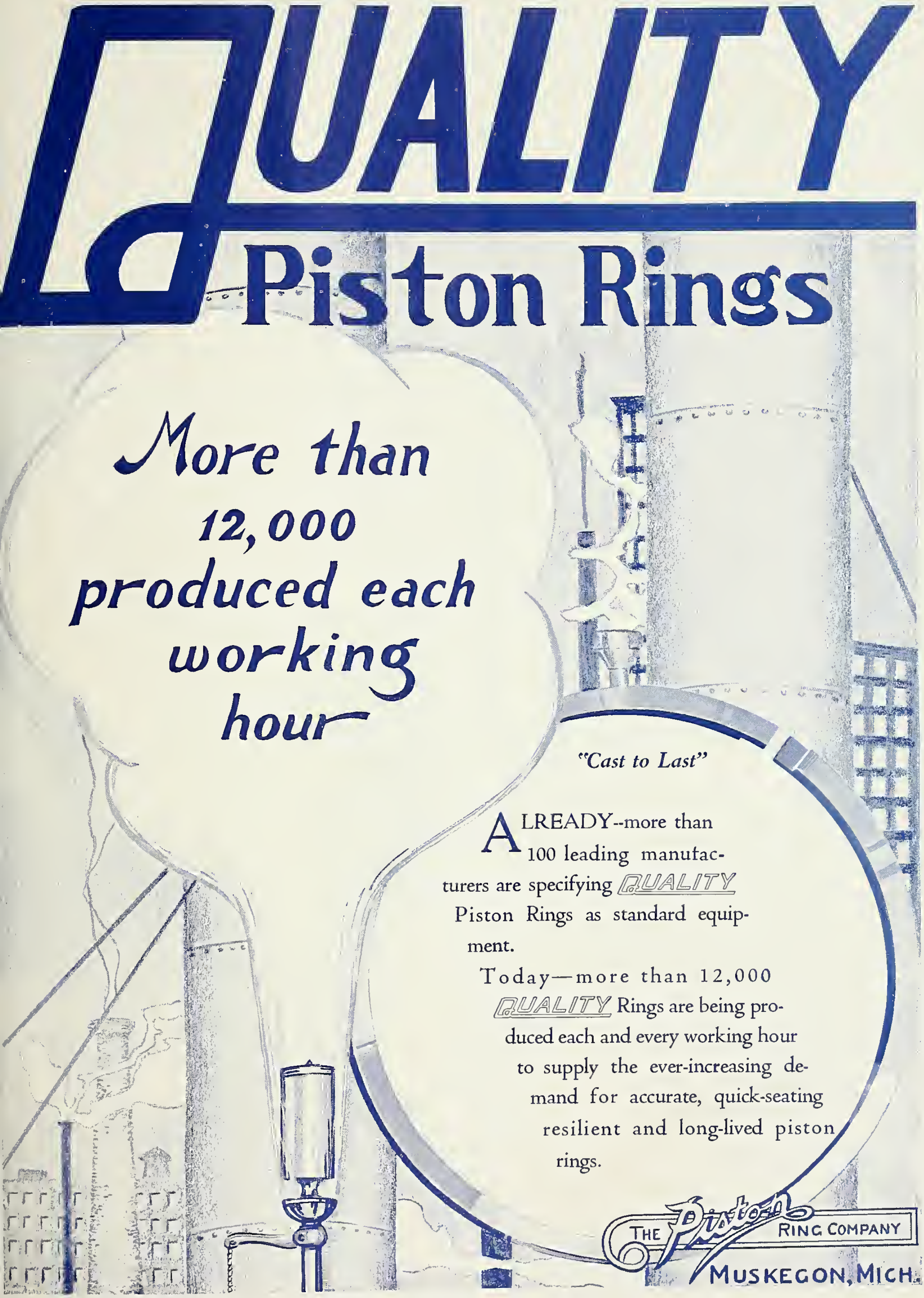

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By William Knight M. E.

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By P. D. Johnson

The Timing of Airplane Races

By B. Russell Shaw

Airway Landing Fields

By Lieut. C. E. Crumrine

An Open Letter To The Members Of The Sixty-Eighth Congress Clearly Outlining Their Duty To The American Aeronautic Industry

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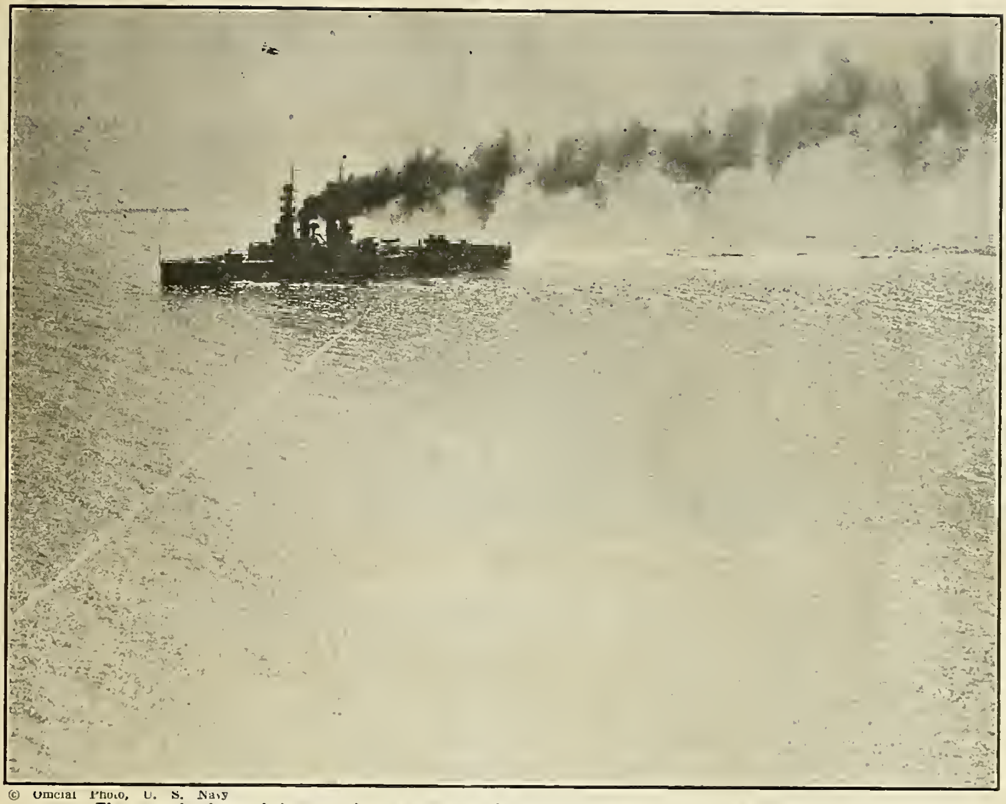


© Official Photo, U. S. Navy
The torpedo dropped from a plane is sure death to war vessels. A torpedo making a direct hit against the Oklahoma

The Development of Air Power Policy

By Arthur R. Blessing

THE Versailles peace conference and the Washington armament conference both diplomatically sidestepped the important question of air power policy. Aircraft constitute a comparatively recent development and a brief résumé shows that it is destined to play a very significant part in future national and world policies.

Policy is defined by the Century dictionary as follows: "The object or course of conduct, or the principle or body of principles to be observed in conduct; specifically, the system of measures or the line of conduct which a ruler, minister, government, or party adopts and pursues as best for the interests of the country, as regards its foreign or its domestic affairs."

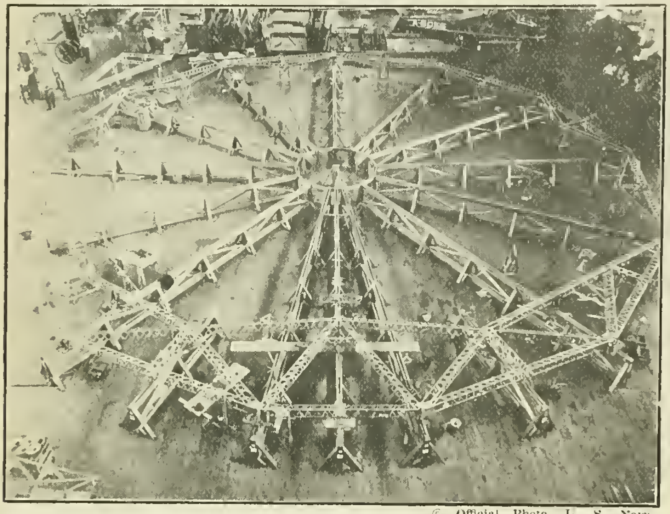
Just how may this definition be applied to air power, either past present, or future? Air power in the recent past has played an important rôle in national and international calculations. At present, practically every country is including air service in its financial estimates for defense. The fact that, except in a general way, air craft was left untouched at the Washington conference has furnished a wide scope of possibilities for future shaping of both foreign and domestic policies all over the World.

No country can now consider itself isolated and this inescapable conclusion must be taken into account. Control of the seas has always been the most important object in view. But now the control of the seas will have to be secondary to or at least parallel with the control of the air.

The history of air power policy is necessarily a recent one. Prior to about 1910, it did not figure to much extent in the considerations of international or even national questions. Since the close of the American Revolution, sporadic attempts have been made to use balloons and kites in warfare; but not until the present century has air power been used very effectively. In 1910 the British military authorities first began to consider seriously the possibilities of the air service as an auxiliary aid to national defense. The year 1911 is recorded as having been the first to see actual use of an airplane in warfare; when in fighting on the Mexican border, airplanes were used for reconnaissance work.

In the Balkan wars, the new arm of defense and offense first began to loom up as a serious factor. In the war between Italy and Turkey, airplanes were used principally for scouting; however, airships proved rather more effective in bomb dropping. From this time until the European war broke out, the prospective belligerents bent all energies towards developing and perfecting their aircraft for war. However none of the nations as yet realized the changes in almost every branch of aviation that the War was about to produce.

At the beginning of the War, avia-



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Assembling the ZR1 at Lakehurst, N. J. The first American-built airship

tion was still in a more or less scientific state of experimentation. The machines were low-powered and crude. They had no equipment either for real fighting or for adequate reconnaissance; and could stay in the air only a comparatively short time. The pilots had had no previous war experience and simply had to develop their own technique of fighting, both defensive and offensive.

After aviation as a fighting force began to be taken more seriously by the military authorities, specialization started to grow and many new types of fighting aircraft were evolved. As the War progressed, aviation development became more and more extensive, and all sorts of accessories, organizations, formations and the like came into prominence.

Definite control of the air became a prime necessity and no formation of aerial tactics was too elaborate to gain this control. Back of the fighting lines, an entire new organization had to be built up to furnish supplies and to make repairs. Industry had to be recast so as to furnish the airplanes, their engines and other mechanical necessities. All of this activity was consciously or unconsciously moulding a definite air policy.

The committee on aircraft at the Washington conference felt that aviation was entirely too large a proposition for them to handle and recommended that a later conference be called to discuss this subject by itself. Although agreement was reached on limitation of aircraft carriers, this means comparatively little taking the matter as a whole.

The general air policy of every country is now looking toward an unquestioned security within its own territorial limits. Bases are being established that will adequately support this policy. Though a country may be insular or continental, it is entirely capable of developing aviation. Assuming that a country is too poor to afford one battleship of the Dreadnaught type, it can nevertheless build and equip several airplanes at less than half the cost of a small cruiser. Little countries, adequately provided with airplanes will have to be considered in future diplomatic channels. A larger power will be able to help organize the air forces of several small countries and thus have many potential allies in case of future conflicts. The so-called balance of power will be subject to more severe fluctuations, now that an arm of service is not limited to a few rich nations.

The domestic policies concerning aviation are inextricably tied up with commercial flying, with all of its problems of governmental control and regulation, subsidies, aeronautical associations and allied questions. With the exception of the United States practically all of the larger countries have granted subsidies to civil aviation since the War. This has been a great factor in keeping alive the aviation industry, causing large manufacturers to train pilots and mechanics, to develop aircraft as a transportation unit, and to popularize the whole scheme.

It is apparently universally realized that the next decade is to be a critical period of time and that these few years will really provide the foundation of this new industry. Governmental regulation of some sort has been already provided in most cases and will be an absolute necessity in all, in order to provide a standardization and a consistent program to be followed. This applies not only to the commercial side of the industry but to the training of personnel, mapping of the country, and co-operation between goverment departments.

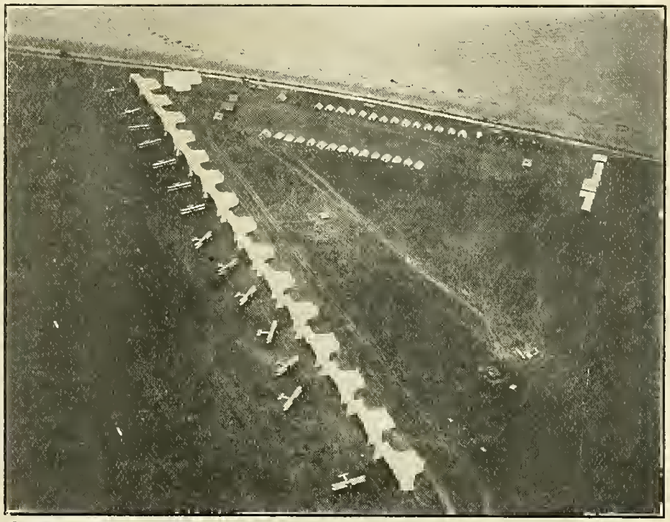
The more that commercial transportation by air can be increased, the more familiar will the layman become with aviation and the more readily will he contribute to its advancement. Aeronautical associations also are being extensively organized all over the world. The new National Aeronautic Association in the United States is a typical example. Commerce demands speed, and many countries have taken up aerial mail service. This phase of aviation has proved so successful that it is being rapidly extended.

From the military point of view, all of the large powers with the exception of Great Britain have preferred to keep the Army air service and the Naval air service as distinct units. Great Britain on the other hand failed in this scheme but since 1918 has successfully built up a separate aviation corps called the Royal Air Force.

An aircraft policy for national defense can be quite advantageously controlled and regulated by the government; but control for civil aviation is a different matter. In countries where subsidies have been granted, it is easier than where this plan has not been adopted. At present, aviation conditions are rather chaotic in the United States but there is a bill now pending in Congress designed to correct this state of affairs. This bill is intended "to create a Bureau of Civil Aeronautics in the Department of Commerce, to encourage and regulate the operation of civil aircraft in interstate and foreign commerce, and for other purposes."

The question of the actual value of the new air service to the older military and naval services is still open to discussion and is much debated. Tests in the United States have been made of the effect of bombs on obsolete battleships. While these tests were not made under actual warfare conditions, the results were rather startling to the average observer. The following extract from the Report of the Joint Board on Results of Aviation and Ordnance

Tests held during June and July 1921 gives an authoritative opinion on this controversy: "The aviation and ordnance experiments conducted with the ex-German vessels as targets have proved that it has become imperative as a matter of national defense to provide for the maximum possible development of aviation in both the Army and Navy. They have proved also the necessity for aircraft carriers of the maximum size and speed to supply our fleet with the offensive and defensive power which aircraft provide, within their radius of action, as an effective adjunct of the fleet. It is likewise essential that effective anti-aircraft armament be developed." It is thus quite definitely concluded by a body of experts that aircraft are a necessity to both the military and naval branches of defense.



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Naval air squadrons of the Pacific go into camp on the Pacific Coast

In the formation and development of an air power policy, there are many factors that must be taken in to consideration. War as an institution cannot be said to be over. Every nation feels that it cannot afford to neglect aircraft because of its sheer potentiality of force if for no other reason. Success or failure of a nation's policy depends in great measure upon the amount and character of armed force behind it.

Probably the outstanding factor to be considered in aircraft policy is SPEED. Not only speed itself but its intimate relations to mobilization, transportation, protection, and action, both offensive and defensive. The element of surprise plays a most effective part in war. Thus far nothing has been devised that can exceed the speed of aircraft and their consequent ability to surprise the opposing forces. The possibility of mobil-

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Looking North over Havana, Cuba, and entrance to the harbor izing the military and naval forces may depend to a large extent upon the outcome of the initial aircraft movement.

Not only are airplanes a protection to the transportation of troops and supplies by land and sea; but they constitute a guard to large dirigible airships. The latter are being rapidly developed as a means of relatively quick transportation and some authorities maintain that they will be a most decisive factor in future calculations of logistics.

The aircraft will be able to carry their own airplanes as well as supplies, thus obviating the necessity for the protecting craft to return to their bases. This will considerably increase the radius of effective action. With the ability of both types to operate in the same medium, an airplane flying slowly can alight on the top of a dirigible without the need of the latter changing its speed or direction. This is an obvious advantage over an airplane alighting on an aircraft carrier as the latter is of course subject to the motion of the waves.

Meteorologists state that there is a constant wind of about 250 miles per hour velocity at a level of approximately seven miles above the earth's surface. This wind is always present and is perpetually blowing from West to East. Assuming an average speed of 100 miles per hour, this would indicate a relative aircraft speed of 350 miles per hour in an easterly direction. On account of the extreme altitude, it is problematical just how much of this level can be used as a practical route. Also the fact that this wind blows in only the one direction has a direct bearing on relative speeds in returning from East to West.

In the consideration of aviation bases and their supplies, it is quite apparent that bases for aircraft would not need to be very close together. An American aviation expert asserts that with one adequate base in New Jersey, the entire coast from Chesapeake Bay to Boston can be easily defended. Aircraft in distress can communicate with their bases by radio and summon supply or repair airplanes to be sent out to their aid.

The psychological factor is a great determinant in the formation of any policy and peculiarly so in relation to air power. Many conflicting statements have been made relative to the German airship raids in England during the late War. However, the consensus of official opinion seems to be that their moral effect was very great, particularly in the industrial cities.

There is no doubt but that a future conflict will involve the entire civilian populations. Formerly battles on the sea affected only the combatants directly. On land, only the civilian populations suffered that occupied the country being actually invaded by a hostile army. However aviation extends the theater of war measurably and the fear of the unknown tends to break the general morale in all sections of the invaded country. Marshal Foch in urging air defense for France made the following significant statement:

"One of the greatest factors in the next war will be aircraft. The possibilities of aerial attack are almost incalculable; but it is clear that such attack, owing to its moral effect, may impress public opinion to the point of disarming the government."

Another angle of the psychological effect and its consequent reaction upon national consciousness was clearly shown by the successful trans-Atlantic flight of the United States flying boat, NC-4 in May 1919. This was a most impressive demonstration of the extensive use to which large aircraft can be put. The effect was further enhanced by the remarkable non-stop flight of a British bombing plane from Newfoundland to Ireland in June 1919; and also the flight of the R-34, a British dirigible that cruised from Scotland to Long Island in July 1919. The proposed "trans-Pacific and "Around-the-World" flights will cause a still stronger feeling as to the potential possibilities of aircraft. The latter contemplated flight may be especially compared to the sending around the World of the United States fleet by President Roosevelt in 1908. That this voyage was a most impressive psychological determinant in policy and caused a great addition to American national prestige cannot be denied.

Inasmuch as the passage of aircraft in both peace and war is subject to international rules and regulations, the question is at once raised as to how the nations have already dealt with this matter. In the first Hague conference in 1899, it was proposed "to prohibit the throwing of projectiles or explosives of any kind from balloons, or by any similar means". Despite the intermission of less than a generation, it was a far cry from that time to the bombing operations of the European War. Policy changed over night and all suggested international codes for aircraft were thrown to the wind.

In the Versailles peace conference, a committee took up the aircraft question and decided that every state has complete and exclusive sovereignty in the airspace above its territory and territorial waters. As this treaty was not ratified by all the belligerents, the international status of aircraft is still undetermined. Sooner or later, an international convention of some sort must be held to take up this increasingly important matter. Considering the mobility, speed, and ability of aircraft to cover great distances, no analogous land or sea vehicle rules can be adopted bodily by aerial navigation.

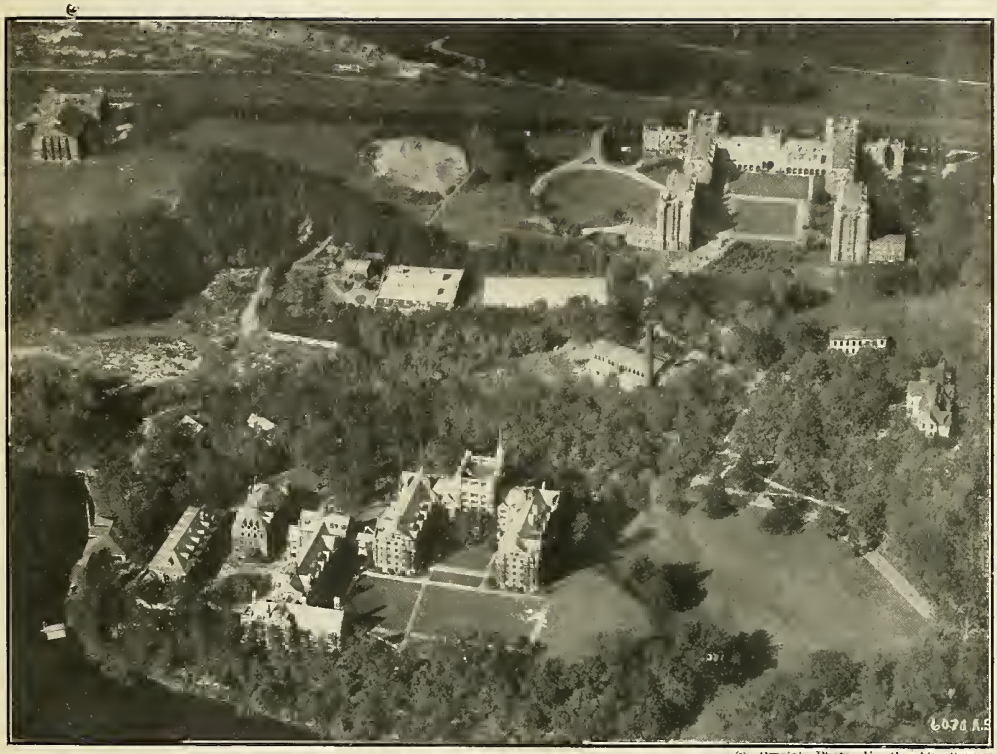
An outgrowth of the conference at Versailles referred to above is a so-called International Commission for Air Navigation, functioning under the League of Nations. Although the provisions of this commission do not directly affect non-members of the League, they provide an excellent foundation for any future aerial navigation agreement that shall be truly international in scope. The rapidity with which situations are changing in regard to aviation makes any policy, particularly one of international action, out of date almost as soon as it is written. Hence there is a tendency among the powers to let this important question drag along indefinitely.

Prophecy is dangerous! This is especially true concerning a subject that seems to be in such a state of flux as aviation. However the near future will in all probability reveal developments that will materially alter any aviation policy in force today. The tremendous changes due to be made because of pilotless, gyroscopically-controlled flight of automatic airplanes will cause many problems. Another consideration is wireless control of naval vessels, aircraft and torpedoes. The ability to pilot an airplane and send printed radio messages to land stations by means of a small contrivance resembling a typewriter will almost revolutionize intercommunication.

Mechanical inventions such as the helicopter that ascends and descends in a vertical plane must be taken into account. Although gliders are comparatively unstable for military purposes, the suggestion has already been made that they be fastened to motor-powered aircraft and used, as trailers are now used behind a motor car.

While some ideas seem marvelous and others foolish, it was only a generation ago that aviation itself was little more than a dream. Today it is almost too large a proposition for national and international consideration. Tomorrow simply cannot be visualized to much extent, and na-

(Concluded on page 181)



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Wellesley College from the air—a good example of aerial photography.

Commercial Aviation: Some Truths on the Subject

By P. D. Johnson, of the Boening Aircraft Corporation of Seattle, Washington and Vice-President and Governor Ninth District National Aeronautic Association of U. S. A.

IGNORANCE and exaggeration are the Scylla and Charybdis of aviation. The monstrous Scylla barked like a dog. She had six long necks supporting six frightful heads. In each head were three rows of deadly fangs. Woe to all who came within her reach. Yet, despite her ravages, she did no more harm to progress in her day and age than the ignorant blasts of would-be aeronautical experts are doing today. And the public, at the hands of aeronautical exaggerators, is called upon daily to swallow a bigger load than Charybdis ever did, although that horrible creature swallowed the waters of the sea thrice every day and thrice threw them up again.

Munchausen-like we have overshot the mark without romantics and heroics of the "conquest of the air", and, at the same time, we have pushed grim pessimism to the extreme in our front-page stories of the disasters "conquest". Such perversion is utterly wrong: it endangers public misconception; it serves no useful purpose.

We must apply a discount of one hundred per cent to the croakings and skepticisms of those who see in aviation nothing more than a swift and somewhat messy method for crazy aviators to kill themselves along with their silly trusting friends. And, by the same token, we must do the same thing to the extravagant claims and romantic theories of those who recognize in aviation the one and only accomplishment of the race, perhaps mentioned in Revelations, the belated appearance of which has been holding back the millenium.

"Pitiless publicity", if truthful, will not endanger aeronautical progress where the general public is concerned; it will help the more. For, with both doubt and mushy glamor stripped from actual accomplishment, we find that no other mechanical achievement since man came out of the prehistoric caves has advanced so far in so short a period as the science of aeronautics. Its astounding record needs no apologies nor support beyond the truth.

While much of the rapid development in aeronautics must be credited directly to necessities incident to the greatest of all Wars, the only legitimate use for aviation in this world is *Commercial.* Used as such it is a blessing. Used otherwise it is a curse. For if the future major effort in the development and operation of aircraft is to be military and naval, as some claim, it would have been better for the world had such a thing remained unknown.

As a weapon, or a conveyor of weapons, nothing so deadly and inhumanly efficient as unopposed aircraft has ever been conceived by man. Nothing is safe from the airplane or airship; towns and cities on the seacoast or far inland are easy prey. Quite the opposite to defense in land warfare, there is more danger than safety in numbers and concentration against aerial foes. Death-dealing bombs, annihilating gases, liquid fire, lives snuffed out in countless numbers and destruction unnamable lie in the wake of wartime aircraft.

We hear from all sides that America is lagging behind Europe in every phase of aviation. This is less than a half-truth. Leaving military and naval considerations out of the discussion, and notwithstanding continued governmental indifference, commercial aviation in the United States is making encouraging progress. We are little, if any, in the rear of European achievement. To be sure, Europe has a great many air transport lines operating on regular schedule, while we have but a half-dozen. But when flying in Europe is compared on a mile-for-mile and passenger-for-passenger basis with what is being done in this country we find no cause for shame or discouragement.

In aeronautical research, with the possible exception of Germany, driven to research by Allied restriction and control of aviation, we lead the world. Our Air Mail is the most successful and by far the largest single air transportation enterprise in the world. We have the largest company in the world which operates air boats on commercial lines. American equipment holds the endurance, speed and altitude and long-distance, non-stop records of the world. This is not boasting, it is the recital of facts, known to those who follow the records of the science and art.

Yet the record of aviation in this country is so far short of what it should be that one is led to believe that the American public is the most patient known to civilization. This is a logical and obvious conclusion when one appreciates the importance of air navigation to a nation like this one of ours. The very geographical characteristics of our country, with its immense domain, with large urban centers scattered through its broad length, and the ever increasing value of *time* in mercantile and industrial transactions make it emphatically and undeniably true that we must employ air navigation on a grand scale to supplement existing methods of surface transportation now in use and some of which are now rapidly becoming obsolete.

The chief cause of general inaction toward aeronautical development in America is the lack of laws to foster and govern its growth. However, the Civil Aeronautics Act of 1923, introduced into the House of Representatives on January 8th, by Hon. Samuel E. Winslow, Chairman of the Interstate and Foreign Committee, one of the most constructive legislative measures placed before Congress since the Wright Brothers gave to the world mechanical flight on December 17, 1922, seems to meet the present needs.

This bill provides for a Bureau of Civil Aeronautics in the Department of Commerce, and is the first step made by our government to make flying safe and sane and to place it on a parity with other interstate transportation activities.

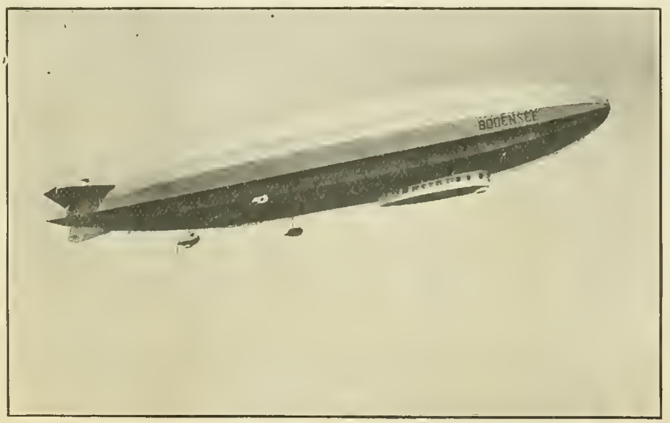
As stated, the development of commercial aeronautics in this country has been held back by reason of the non-existence of laws regulating and fostering aeronautical enterprises. Non-regulation has been the cause too, of practically all the fatalities in flying outside of the military and naval establishments.

This Civil Aeronautics Act, will establish and promote the aeronautical industry and commercial air navigation throughout this country, by providing for the authorization and the carrying out of the inspection and licensing of aircraft and pilots, establishing certification of aircraft routes and terminals, establishing rules of the air and air administration and co-ordinating, the Military, Naval, Postal and Commercial activities of the country into a great cohesive enterprise, which will be of tremendous economic benefit and one of the most important factors in the national defense.

Those private concerns operating aircraft, which most closely approximate the standards of the regulatory measures in the proposed act in connection with the conduct of their business, in the last two years have carried thousands of passengers without a fatality. The fatalities in commercial flying have been due to itinerant and gypsy fliers, who, however, carried several hundred thousand passengers and caused one fatality in every 600,000 miles of flight; a record placing the safety of flight in the United States ahead of every other country in the world.

It is also true that the total mileage flown in the United States has exceeded the combined mileage of all the countries in Europe. It will thus be seen that the use of Aviation on a grand scale in the United States has really been waiting upon the enactment by Congress of such legislation as that proposed by Congressman Winslow. Capital has been skeptical of aviation because it has been an "outlaw" activity doing an interstate business without the aid of interstate laws. Hence insurance companies have either refused to write aeronautical insurance or have charged such tremendous premiums that insurance was out of the question.

The National Aeronautic Association is squarely behind this constructive act and sees in its passage the removal of the last barrier preventing the complete development of aviation in the United States. By the enactment of the Winslow Bill, thus encouraging the investment of capital, there will be added to our present transportation systems that swiftest of all methods of passenger, freight, and mail carrying: Aviation.



The Zeppelin "Bodensee" passenger carrying airship © Harry Vissering

The Timing of Airplane Races

By B. Russell Shaw, Executive Vice-chairman Contest Committee N.A.A. of U.S.

The methods used in timing the national races at Detroit last Fall were, without doubt, the most complete and accurate ever employed in an aeronautical meet. The electrical timing and recording device insures an accuracy impossible by any of the other methods generally adopted. AERIAL AGE *feels that Mr. Shaw's article is of prime interest to every aero club in the world.—Editor*

THE timing apparatus is one of two constructed by Mr. A. P. Warner, of the Warner Speedometer Corporation, Mr. Harry K. Knepper of Detroit, and Mr. Ode Porter of Indianapolis, Ind. Mr. Porter has worked for over eleven years on the present timing machine, adding new features until now its action gives unvarying time down to 100th of a second in a printed record which can be checked for absolute results. The actual timing apparatus consists of a certified chronometer of exceptional accuracy under all climatic conditions, having been tested at the Bureau of Standards and Naval Observatory at Washington, D. C. The certificate of performance is remarkable in that the variation under extremes of temperature is practically negligible and as stated by the report received from the Bureau of Standards: "The chronometer is one of the most perfect that has ever been tested in this institution." This chronometer is electrically connected to an instrument, the construction of which would require a lengthy and technical description. Therefore, only its general construction will be touched upon.

This timing machine consists of a small 30 volt motor geared down to run a shaft ½ revolution per second, on this shaft are 4 disc wheels; namely, hour, minute, second and hundredths. The hour is numbered from 00 to 59, the minute is numbered from 00 to 60, the second is numbered from 00 to 60 and the hundredths is numbered from 00 to 95 around to the half, and the other half from 00 to 95. This hundredths wheel is scaled by hundredths and is secured to the shaft by a small ratchet and at end of shaft is a cross piece of hardened steel, called governor, as this shaft will run about 5 hundredths fast, allowing the correction to be made every half second by the aid of the ship chronometer in which is attached to the escapement lever, a contact that makes and breaks with each second. This contact is operated with 6 volts, with a 2 MF condenser. This contact operates a relay which makes a contact with two 12 volt coils called governor coils. These coils are magnetized every second and operate a bar in such manner as to retard the governor yoke or cross piece every second. The other wheels on shaft are free and held in position by three 8 tooth pinions, of 4 long and 4 short teeth. As the hundredth wheel makes ½ revolution, this pinion advances the second wheel one number or second and every revolution of the second wheel, the other pinion advances the minute wheel one number or minute and so on with the hour wheel. On top of these wheels a paper tape 2¼" in width is automatically fed, and on top of this paper tape is a printing ribbon which extends across the paper tape and the four timing wheels. Directly above these wheels are four small hammers, set into a square frame hinged in the middle, the opposite end being drawn up by two 12 volt magnets, throwing the hammers down upon the print ribbon, paper tape and hour, minute, second and hundredth wheel, thereby getting the impression of the figures on the four timing wheels which will give the time to the one hundredth part of a second. A hand trap having a closed contact is in series with a relay of 6 volts, this relay makes contact with the 12 volt unit coil. This trap is connected with the instrument by an electric cord of arbitrary length. It has been found that the hand can be contracted with greater certainty and more quickly than the finger pushed on a button. This handle is therefore gripped entirely by the hand of the timer, who sits under the sighting wires and contracts the handle the instant a plane passes through the plane of the sighting wires. The failing of the hammers to print the time, momentarily stops all the printing wheels so as to get a perfect print, and they then are released automatically and a spring on each printing wheel makes it catch up for the time lost while the time is being printed.

By using a circuit through which the current is constantly flowing, in which a bank of lights is placed in series, it is possible to tell the instant the circuit becomes inoperative. This accounts for the fact that the breaker in the hands of the timer breaks contact when the hand is contracted. When the time of the plane is taken the number is called out by the timer as he contracts the breaker. The recording timer who is in charge of the instrument writes the number of the plane opposite the time as it is stamped on the tape. The tape passes from the machine to the scorers who set down the times, thus indicated, on their score sheets.

In the contest for the Curtiss Marine trophy, October 8, 1922, in which 160 miles were flown over a 20-mile course a timer's stand was erected opposite the lower turning pylon and in a direct line with the starting and finishing line designated by colored buoys anchored in the river. On top of the timer's stand a pole was erected approximately 15 ft. high. This was placed about 12 ft. directly behind the position for the timer and in line with the starting and finishing lines. From the top of the pole a taut wire was extended downward at an angle of approximately 45 degrees to the end of a horizontal spar pointing outward in front of the timer's position.

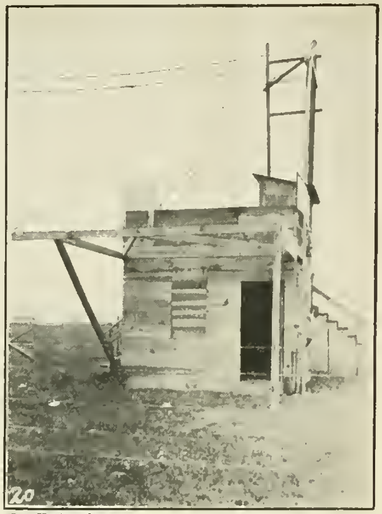
© Kalic Bros.
Ode Porter, who with H. K. Knepper, invented the timing apparatus shown

Five feet from the top of the vertical pole another wire was attached and carried down to the same spar and attached 5 ft. back from the end. These wires were very carefully trued vertically and lined up, exactly cutting the starting and finishing line and at the same time establishing a vertical plane into infinity so that the timer by sighting across the two wires either vertically or horizontally could "clock" a plane the instant it passed through the imaginary plane thus established through the sky.

National Airplane Races

The same general conditions were used in timing the National Airplane Races on Oct. 13-15 as described in the foregoing paragraphs, the only change being that the timer's stand was erected about three quarters of a mile below the turning pylon located on Selfridge Field. The stand was approximately one-half mile from the normal line of flight. The sighting wires were established in a similar manner to those described above and the plane through the sky was at exactly 90 degrees to the line of flight laid out by the U. S. Lake Survey Office. Starting and finishing lines were marked across the field in a three foot strip of white, extending from just in front of the timer's stand across the field and 100 ft. beyond the normal line of flight. This made it possible for the plane to make a wide turn and pass over starting and finishing line at any position and any altitude without causing inconvenience or inaccuracy on the part of the timer.

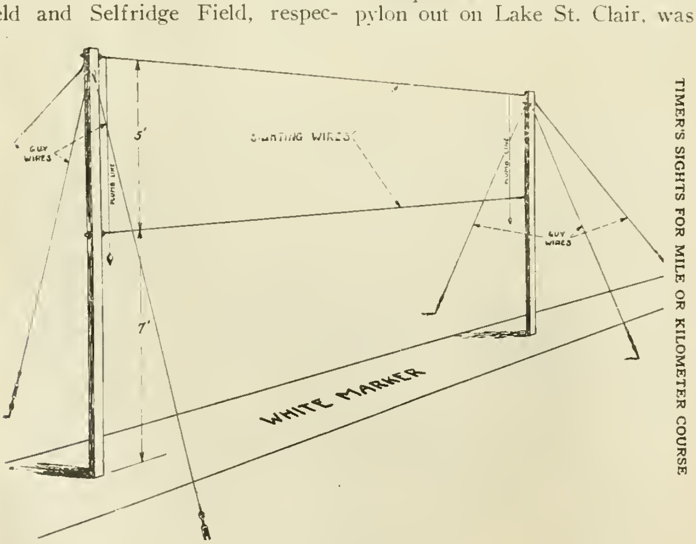
During the races on October 12th and 13th the three turning pylons situated at Gaukler's Point, Packard Field and Selfridge Field, respectively, were connected with the timer's stand by an uninterrupted open telephone circuit. As each plane passed a pylon a judge announced the passing into the telephone transmitter. This turning was then recorded by a Scorer seated in the timer's stand and equipped with head phones. This made it possible to know at all times the exact location of every plane on the course, and also to determine where a plane had a forced landing in case its pylon turning was not announced at approximately the proper time.



Kalle Bros.

Photo showing sighting wires at timer's Stand

In the Pulitzer Race on October 14th the turning pylons at Selfridge and Gaukler's Point were connected with the same circuit used the day before and the U. S. Steamer *Dubuque*, which marked the turning pylon out on Lake St. Clair, was in constant communication by wireless to a powerful transmitting and receiving set located on the timer's stand. In this way the same relative communication was had as that used on the previous two days.



Timer's sighting wires

Establishing World Speed Record

The U. S. Lake Survey office supplied two of their expert surveyors who laid out a course on Selfridge Field to comply with the requirements established by the F. A. I. The course was measured off as nearly into the prevailing wind as possible. The one-kilometer distance being established approximately across the centre of the field in a diagonal direction. A stake was driven in the ground and the kilometer measured by the Government surveyors using a standard steel surveyor's tape. The course was kept in a perfectly straight line by means of a transit and a second stake driven at the far end of the kilometer. The distance was then checked back for correctness. The required 500-meter distance was next laid off beyond each end of the kilometer to conform with the F. A. I. requirements, and clearly marked by stakes. An observer was stationed at each of the 500-meter distances and supplied with large white flags to mark this point. At each end of the kilometer two horizontal wires were placed one above the other, five feet apart, the lower wire being seven feet from the ground. The wires were placed directly over the stakes driven into the ground by the surveyors and lined up vertically with plumb bobs. The timing apparatus, which was the same as that used during the previous days' races, was set upon the field at one end of the kilometer straightaway. Two electric cords with breakers were attached to the instrument, one to be used by the timer at one end of the course, and the other attached to a long wire extending down the field for use by the timer at that end. A field telephone was also used to give constant communication between each end of the course. Timers and observers were stationed at both sets of sighting wires, and the ends of the kilometers were marked with large red flags.

The Efficiency of a Wind Tunnel

By William H. Miller

THE most satisfactory definition of the efficiency of a wind tunnel should give as extreme limits of numerical evaluation: zero and unity. It is highly desirable that the resulting mathematical expression should show how such factors as the motor and the fan efficiencies affect the overall efficiency; and, furthermore one should be able to develop from such a definition the efficiency of the "tube" alone.

A state of steady motion of a perfect fluid in an *ideal* wind tunnel would exist indefinitely, as there would be no losses. In the actual tunnel, the function of the motor-fan group is to overcome the various losses. The *useful* energy may therefore be conveniently defined by the kinetic energy, E_c, in the experimental chamber; that is

$$E_c = \frac{1}{2}\rho A_c V_c^3 \qquad (1)$$

where ρ is the absolute density of the air, A_c the cross-section area of the stream in the experimental chamber, and V_c the mean velocity in the experimental chamber.

The total amount of energy transformed in unit time by the complete unit is $(E_c + E_s)$, where E_s is the energy supplied *to* the motor. The *overall* efficiency of the complete unit may then be defined by

$$\eta_o = \frac{E_c}{E_c + E_s} \qquad (2)$$

If the brake-power and efficiency of the motor be respectively designated by P_m and η_m, it is evident that we may also write

$$\eta_o = \frac{1}{1 + \dfrac{P_m}{\eta_m}} \qquad (3)$$

In defining the efficiency of the tube and fan as a separate unit, it is only necessary to charge to the unit the amount of energy given by

$$E_c + E_s - (E_s - P_m) = E_c + P_m = E_c + \eta_m E_s$$

since P_m is the brake power absorbed by the fan. For this unit, with efficiency η, we have

$$\eta = \frac{E_c}{E_c + P_m} = \frac{E_c}{E_c + \eta_m E_s} \qquad (4)$$

It is now easy to see that, in order to obtain a definition of the *tube efficiency* we need only charge to the tube the kinetic energy in the experimental chamber plus the work done in unit time by the propeller *on* the air; thus

$$E_c + E_s - (E_s - P_m) - (P_m - P_u) = E_c + P_u$$

where P_u is the useful power delivered by the fan, and must be equal to the total loss of head, H_f, due to friction, multiplied by the *weight* of air handled in unit time; that is $P_u = g\rho H_f A_c V_c$. The tube efficiency η_T is then given by

$$\eta_t = \frac{E_c}{E_c + P_u} \qquad (5)$$

And, since the kinetic energy in the experimental chamber is equal to the product of the weight flow per unit of time and the velocity head in the experimental chamber; the definition (5) may be written

$$\eta_t = \frac{1}{1 + \dfrac{H_f}{H_c}} \qquad (6)$$

It is readily apparent that, as long as the conditions of flow permit the assumption of constant density throughout the tube, the tube efficiency is independent of speed. Also, since the efficiency of a propeller working at a fixed point is independent of its angular velocity, the same assumption leads to constant fan-tube efficiency. The overall efficiency, however, will usually vary slightly with speed, on account of the variation of the efficiency of the prime mover.

On account of the previous relations established, it will be easily seen that, in addition to (6) the other efficiencies may be expressed in terms of the friction and velocity heads; thus

Fan-tube efficiency:—

$$\eta = \frac{1}{1 + \dfrac{H_f}{H_c \eta_p}} \qquad (7)$$

where η_p is the propeller efficiency.

Overall efficiency:—

$$\eta_o = \frac{1}{1 + \dfrac{H_f}{H_c \eta_p \eta_m}} \qquad (8)$$

The formulas (6), (7) and (8) are in the most practical forms as written, since the various losses throughout the tube, etc. are usually expressed as fractions of the velocity head in the experimental chamber.

Finally, it is noted that since the "energy ratio" of a wind tunnel is usually defined as the quantity

$$R = \frac{E_c}{E_s}$$

the relation between energy ratio and overall efficiency is

$$\eta_o = \frac{R}{1 + R}$$

In the following table, we give the corresponding energy ratios and overall efficiencies of a few well known wind tunnel installations:

Table

Installation	Energy Ratio (R)	Efficiency (s o)
McCook Field (14 in.)	3.65	78.5%
Bureau of Std's. (3 ft.)	3.04	75.2
Langley Field	1.82	64.5
Eiffel (2m)	1.35	57.5
Mass. Inst. Tech. (4 ft. Venturi type)	1.31	56.7
Gottingen	1.09	51.1
(8 ft. x 8 ft.)	0.88	46.9
(8 ft. x 8 ft.)	0.88	46.9
Curtiss (7 ft.)	0.69	40.8

The Strength and Air Resistance of Tapered Struts

By Edward Adams Richardson

IN number 152 of the Technologic Papers of the Bureau of Standards, an attempt is made to derive equations for the strength of a particular form of tapered strut. The resulting equations are unwieldy, and must be solved by trial and error methods, as no direct solution is possible. Furthermore, the form of presentation of numerical results is such as to lead to the belief that no special benefit would accrue through the use of such struts. To correct this impression and deduce strength equations of the simplest form are the aims of this paper.

First let us derive the equations of strength. We will consider a strut fixed at one end, with axis initially vertical, loaded at the free end by a centrally applied vertical force. Under this loading, the axis of the beam will become curved. We will choose our coördinate axes so that the fixed end of the neutral axis is at the origin, and the initial position of this axis will lie along the X axis. The distance of any point on the deflected position of the neutral axis from the X axis will be "y". The distance of the free end from X will be "a". The load will be "P". The modulus of elasticity of the material will be "E". The moment of inertia of the cross section of the strut at any section will be "I". The simple theory of beams will enable us to write the equation of rate of change in the slope of the neutral axis in terms of these quantities. We obtain,

$$\frac{d^2y}{dx^2} = \frac{P(a-y)}{EI} \qquad (1)$$

In the case of the straight strut, "I" is a constant. If we integrate the above equation for that condition, we obtain the usual Euler strut formula. But we propose to assume that "I" is some function of "x", since our strut will be tapered.

We will find, after some trial, that it is impossible to assume any particular function for "I" which will give a simple integral. In fact, even the simplest types of functions lead to most complex types of integrals. We note, however, that we can integrate easily if we may substitute for the right hand member a function of "x". We may assume that this member is a constant. If we do, it is the same thing as assuming that the moment of inertia of the section is everywhere proportional to the moment of the external forces. We secure in this way a strut of uniform strength.

We shall confine our attention to this particular type of tapered strut. The Bureau of Standards report previously referred to, treats a type where $I = C(l-x)^2$, l being the length of our strut, C a constant.

Integrating the equation below, we have,

$$\frac{d^2y}{dx^2} = k$$

dy

$$\frac{\ }{dx} = kx + c_1$$ Since the left member is zero when x is zero, the constant c_1 must be zero.

$$y = \tfrac{1}{2} kx^2 + c_2$$ Since the left member must be zero when x is zero, the constant c_2 muse be zero.

But $P(a-y) = kEI$

Substituting in this equation "a" $= \tfrac{1}{2} kl^2$, and for y the quantity $\tfrac{1}{2}kx^2$, we obtain, $Pk(l^2-x^2) = 2kEI$, or $P(l^2-x^2) = 2EI$

The strength of the strut is, therefore,

$$P = \frac{2EI_0}{l^2}$$ I_0 = Moment of inertia of section at $x = o$.

If we apply this equation to the case of the round ended strut of length $L = 2l$, our equation becomes,

$$P = \frac{8EI_0}{L^2}$$ where I_0 = Moment of inertia of center section.

Euler's equation for the straight strut is the same if we substitute π^2 for 8. Hence we immediately learn that the ratio of the strength of a tapered strut to that of a straight one having the same value of I_0 for the central section, is $8.00/9.87 = 0.810$.

Before proceeding further, it should be noted that our equations will actually yield round ended columns. We must expect to strengthen the end sections sufficiently to take the direct compression stresses. This will modify our conclusions with regard to resistance and weight, but this correction should not exceed 15 per cent of the differences with which we deal. We shall in any case save somewhat in the size of our fittings, since our strut ends will be smaller, a factor tending in considerable measure to offset the effect of this modification of our theoretical form (as deduced solely on bending moment considerations).

Subject to the limitation imposed, there are a number of ways in which we can vary the value of "I", and each method will yield a different shape of strut. We will consider (A) Solid struts, (B) Struts made of sheet metal of constant thickness, (C) Struts made from straight tubing by hammering, peening, spinning, rolling, or otherwise bulging the tube towards the center, the area of metal cross section being constant along the strut, (D) Struts made by forging or casting, so that all cross sections shall be geometrically similar. In all cases we will assume that the coefficient of fineness is constant throughout the length of the strut. The calculations for the solid strut will be given in full, but only the results will be given in the other cases.

$$I = \frac{P(l^2-x^2)}{2E} \qquad I_o = \frac{Pl^2}{2E}$$

$$\text{Hence } \frac{I}{I_o} = \frac{l^2-x^2}{l^2}$$

But $I = md^4$ So $d = d_o \sqrt[4]{(l^2-x^2)/l^2}$

We may easily find that the volume of such a strut, (actual material) is $\pi/4$ that of a straight strut with same center cross section. We find that the ratio of load supported to weight is 1.03 when that for the straight strut is one. Not very large. But we will find that the projected area ratio between the tapered and straight struts is 0.871. We save 22.9 per cent in resistance and lose 19 per cent in strength by tapering a given solid strut.

The above figures are typical of those given in the Bureau of Standards paper. Tapering would seem futile taking them at their face value.

Let us suppose that we keep the resistance of the two struts equal. In this case we can have a central section 1.148 times the diameter of the straight strut. The moment of inertia will be $1.148^4 = 1.742$ times as great. Our tapered strut has only 0.810 the strength of a straight strut with same central cross section, so our tapered strut has $1.742 \times 0.810 = 1.41$ times the strength of the straight strut of same resistance. The weight ratio is $1.148^2 \times 0.7854 = 1.037$, so the tapered strut is slightly heavier. The tapered strut carries $1.41/1.037 = 1.36$ times as great a load per pound of strut.

These results are most important, and put a very different aspect on the importance of tapered struts. Our table below quotes similar results for hollow struts made on the plans previously outlined. Our first coefficient is the relative weight (to that of a straight strut) for equal loads and equal diameters of central sections. Our second coefficient is the ratio of the projected areas in this case. Our third coefficient keeps the projected area and loads equal, and measures the ratio of weights.

Table I

Type	Coef. 1	Coef. 2	Coef. 3
Straight	1.000	1.000	1.000
B	1.039	0.842	0.677
C	1.235	0.785	0.761
D	0.970	0.871	0.735

It will be seen that we may cut the weight of our struts nearly 30 per cent without increasing the resistance of our machine, simply by properly tapering them. Furthermore, the most suitable type of strut is the one most easily built, the sheet metal affair welded together. We see, further, that we may cut resistance nearly 15 per cent with a weight increase of only 4 per cent.

A discussion of resistance versus weight is too broad for adequate treatment in a short article, but we will, nevertheless, give a few cases to indicate the mode of treatment, and give an idea of the importance under certain conditions of the one or the other. We will use the usual criterion of equivalent weights, although as usually given it is most defective.

Suppose we have an airplane travelling 100 miles per hour, with a power loading of 12 pounds, a typical strut would have $I = td^3$, $A = 6.37$ td, $P = 26{,}000$ pounds, $E = 3 \times 10^7$ $L = 100$ inches, $d_0 = 2.5$ inches. A straight strut would weigh 25.4 pounds, and require 2.12 H. P. to lift it. The power to move it through the air would be approximately, $(0.000204 \times 2.50 \times 100/144 \times 100^2) \times (100 \times 88) \times 1/(0.81 \times 33{,}000) = 1.17$ H. P. Our propeller efficiency is assumed at 0.81. We can afford to increase the resistance to save weight. Yet we can taper our strut without increasing the resistance and save 0.69 H. P.

Next consider a racing machine at 200 miles per hour with a power loading of 4.5. It will take 5.64 H. P. to lift the strut, (assumed as in preceding case), and 9.34 H. P. to move it through the air. In this case we can save 1.82 H. P. by tapering, the air resistance remaining the same. If we tapered, keeping the central diameter the same, we would lose power.

For medium speed commercial machines where economy in power is desirable, and weight lifting is of importance, a small but by no means negligible gain can be secured by proper strut tapering. In racing machines we can economize on power where we have struts by properly tapering. We have not considered the case of struts protected from air resistance but it should be apparent a considerable taper may be used with advantage to reduce weight, since the larger the center section, the less the material needed to secure a given moment of inertia.

Is The Liberty Engine "Obsolescent"?

By L. D. Seymour

THE great aircraft engine designed by America's foremost engineers, developed and given to the military and naval forces of the United States in 1918 by the Army Air Service has neither been forgotten nor abandoned by the Army since the signing of the Armistice. With a large number of the engines available for future use at the close of the war, the Army has spared no effort to continue the unexcelled record of the Liberty.

Resulting from service use and exhaustive tests many refinements have been added and changes made. As new features of design or modification have proven of value, they have been incorporated in the engines in the possession of the Service and given not only to other branches including the Navy Department, but prominent manufacturers and designers for the general advancement of the art of aerial navigation.

While the characteristics of this engine are fairly well known to those connected with the Air Service, it may be found of value to recite some of the outstanding features for those not so intimate with aircraft. As originally designed with a weight of only 800 pounds, a horsepower of 400 was secured with the propeller shaft turning at approximately 1700 revolutions per minute. Two complete ignition systems were installed to guard against the possibility of trouble in the air from that source. Two duplex carbureters were used each divided into two units serving three of the twelve cylinders. Practically four separate carbureters were thus employed, but so set, adjusted and controlled that each cylinder would receive the same quality and quantity of fuel. A most interesting point in connection with the water system is the circulating pump. This pump though of the small centrifugal type is capable of delivering 100 gallons of water per minute with a free outlet. With the foregoing in view it is the more wonderful when compared with the ponderous proportions of even the lightest of steam powerplants installed in electric generating stations where even only a fraction of 400 horsepower is delivered. Not content with these characteristics, however, a constant effort has been made toward greater development with very gratifying results.

It is interesting to note some of the changes that have added immeasurably to the usefulness of an already marvelous powerplant.

In the following paragraphs note has been made of a few only of the changes which have occurred and the reasons therefor. From these one will be able to form an opinion of the work that has been done and what a part of the peace time duties of Uncle Sam's Air Service include.

The Problem of Lubrication

In an aircraft engine all working parts are usually lubricated by a direct oil lead carrying oil under pressure. Even though every means possible is employed to hold this pressure at the right value sometimes too much oil reaches the piston wall. This in the ordinary engine results in oil passing the piston, fouling spark plugs, forming carbon in the combustion chamber, hindering the proper operation of the valves, causing overheating, pre-ignition, etc. So that such a possibility might be reduced to a minimum, four small holes were drilled in the oil pressure relief valve giving an almost perfect balance to the oiling system at all speeds.

As an extra precaution, the pistons have been grooved and drilled so that excess oil is collected and drained back into the crank case or "sump" before it has had a chance of getting to the combustion chamber.

One of the greatest triumphs of McCook Field has been the development of a centrifugal oil cleaner. It has long been the practice of the Air Service to reclaim oil which has been used until impurities such as sediment, etc., have been collected, rendering it useless. This process while resulting in purification to the extent that the oil is of a better quality than the original, requires large tanks, heaters, etc., the weight of which runs into hundreds of pounds. It remained for Air Service engineers to develop the new centrifugal cleaner which is hardly bigger than one's two fists. This cleaner is made an integral part of the engine removing impurities of all kinds from the oil as fast as they are collected. This not only makes it simply necessary to add the oil that is actually consumed but makes draining and washing of the oil system a thing of the past.

Not only the engineer, but any layman can easily appreciate the importance of advantages accruing from these various devices such as: certain, constant, uniform oiling with never a "feast or a famine"; unheard of economy; prevention of carbon formation, cleaning seldom required and overheating from this source unknown.

Fuel System and Fire Hazard

Naturally, in the air, fire is a greater danger than in almost any other place. For this reason no effort has been spared to reduce the chances of a fire starting from the power plant. The difficulties incident are very apparent when it is remembered that a 400 horse power motor must be supported in the light frame of an airplane.

To this end flexible fuel line connections impervious to vibration have been developed. Carbureter air intake pipes where once gasoline vapor condensed and dripped back onto the engine have been led outside and above the engine housing to prevent the collection of gasoline where it could be ignited and cause damage.

By ingenious means and devices the engine's carbureters have been so changed that the gasoline consumption has been reduced approaching one half the former amount. At the same time a much better proportion of gas and air have been secured which gives increased smoothness of operation, flexibility and complete combustion. One of the greatest advantages secured by these changes is the greater range of altitudes at which uniform operation is possible.

Probably the greatest cause of fires in the past has been the fact that gasoline was led to the carbureters under air pressure which, if a leak in the system occurred, caused the entire power plant, etc., to be subjected to a fine spray of fuel. This of course, mixed with air, forms one of the most inflammable mixtures known. All this has been changed now with the successful development of a mechanically operated fuel pump supplying gasoline to the carbureter without the use of pressure in the tanks.

It is a well known fact that due to the rarification of the air at great heights, an internal combustion engine is able to deliver only a small fraction of its sea-level power. The supercharger, another newly developed accessory for the Liberty removes this difficulty by delivering to the engine, at any explored altitude, air substantially the same as at sea level.

The Electric System

Even though other parts and devices of any aircraft engine may be perfect the fact remains that the electric spark which fires the charge must be delivered at all times if there is to be any operation at all. In order to insure this many changes and modifications have appeared to guarantee non-failure from this source. Among other important items in redesign and reconstruction are the following: A 12 volt system has been substituted for the 8 volt, in addition allowing the employment of a self-starter; storage battery improvements; addition of buzzer distributor starters, safety relays, etc.; more completely armored cables and positive connections.

In other small features a recitation including redesigned flexible shafts, larger bearings, stronger gears, water system improvements, etc., could go on for many pages. However, those enumerated serve to show the untiring efforts that are constantly being exerted to keep the greatest war time engine also the greatest in peace. No attempt has been made to keep secret these discoveries which have added so much to our knowledge of engine construction in general, but rather they have been carefully explained and given to all interested in the progress of aeronautics including the Navy, Marine Corps, commercial concerns, etc. This attitude and action of the Army Air Service shows the value of this special research and will go a long way toward the development of the art in general. By such unselfish and patriotic endeavor will aerial navigation the sooner take its proper place in this country as the best means of transportation and communication. More than this the same American spirit is shown to be alive that first gave to the world a practical solution of the problem of flight.

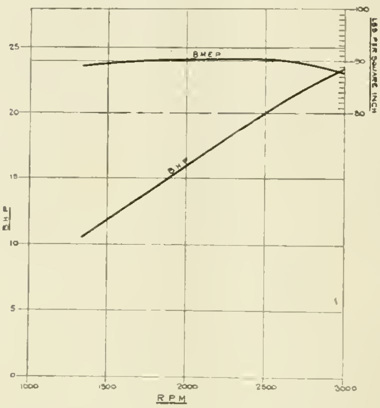
The "Bristol" Cherub Flat Twin Aero Engine

THE growing interest in aircraft of the glider type equipped with an engine of comparatively low horse-power has been carefully watched by the Bristol Aeroplane Co., Ltd., and for the past fifteen months their aero engine department has been developing and perfecting a small 1070 c. c. flat twin air-cooled aircraft unit suitable for this purpose. The unrivalled experience which they have gained with their eminently successful and widely known 400 h. p. Jupiter and 100 h. p. Lucifer air-cooled engines has assisted in the production of a smaller type, soundly constructed and of the greatest reliability.

Twelve or fourteen years ago aircraft pilots were seriously handicapped by the limitations and failures of the small powered engines then in use. Engines of converted motor cycle type—as most of them were—they were probably quite satisfactory on the road when they were rarely run for more than a minute at full throttle, but for aircraft units they were unreliable, and therefore useless. In the development of their new type, the Bristol Company have insisted upon sound reliability and have produced an extremely robust power unit. The new engine has been subjected to exhaustive experiments on the Froude test bench under conditions exactly similar to those demanded by the Air Ministry for large aero engines, and continuous ten hour non-stop power tests have been carried out on the Froude dynamometer.

Two types of engines have been designed—one with driving boss running at crankshaft speed, to be used in conjunction with a chain-driven propeller, and the other with a 2 to 1 gear reduction enclosed in the crankcase.

In this very sturdy little engine all the valve mechanism is entirely enclosed, ball and roller bearings are used throughout, and the lubrication is entirely automatic. This engine can be left to run for long periods at full rated power, without any attention or adjustment—special measures (which are described later in detail) having been taken to deal with the attendant troubles usual with over-



Power curve of the Bristol Cherub

head valve air-cooled engines.

The following are the main details of the engine:—

2 cylinders horizontally opposed.
Bore 85 m/m.
Stroke 94 m/m.
R. A. C. Rating 8.95 BHP.
Rated H. P. 18 at 2,500 RPM.
Weight of Engine Complete 85 lbs.
Petrol Consumption per hour, 12 Pints.
Oil Consumption per hour, ½ Pint

From the illustrations of the engine its clean appearance will be noted, and also the fact that there are no exposed moving parts to lubricate, wear, or require adjustment.

The cylinder construction calls for attention as the head is detachable, and of aluminium alloy, the sparking plug bosses being bushed in bronze.

The valve mechanism is of special interest. A single camshaft with four integral cams, and driven by very robust gearing from the crankshaft, lies inside the crankcase. The cams operate fingers, which in turn operate rocking shafts enclosed in tubes; the rocking shafts are returned by coiled springs, and the mechanism is such that when the cylinders warm up there is no increased clearance between the rocking shafts and valves. Twin concentric springs are used for the Tungsten valves. The whole mechanism is enclosed and automatically lubricated; thus remaining quiet, wear does not take place, and frequent adjustment is not necessary.

The crankshaft is very stiff and robust, and is supported on three ball bearings with thrust bearing.

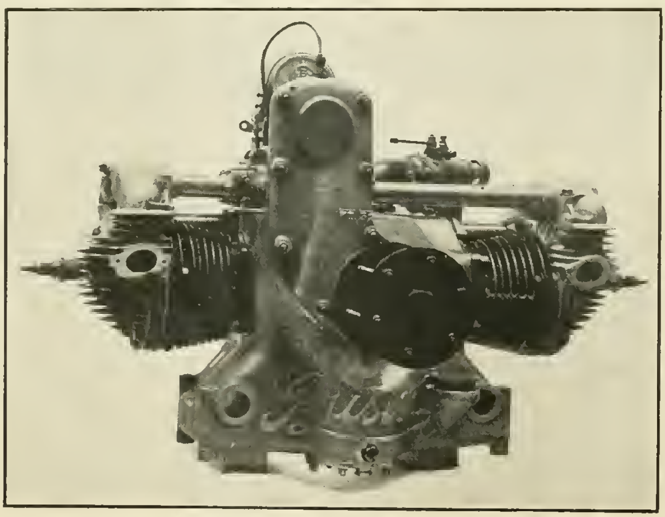
The connecting rods are threaded on to the crankshaft, and run on case-hardened crankpins with 7/16 inch rollers. The big end of the connecting rod has a case-hardened bush inserted. The whole crankshaft and con rod assembly is of very ample proportions, and special attention has been given to the connecting rod roller bearing assembly, so that very long life can be guaranteed under continuous working conditions.

The crankcase is a one-piece casting, arranged at the rear end with a large aperture, which provides for the connecting rod assembly being inserted complete.

Lubrication of the engine throughout is automatic. Oil is positively delivered to the timing gears, camshaft, rocker mechanism etc. and pressure feed is directed on to the connecting rod assembly, from which the cylinders are lubricated by "splash". The necessary lubricant, approximately 1-gallon, is carried in the sump provided in the lower part of the crankcase, which floods the plunger pump. A convenient oil-filler and filter are provided.

Ignition is by B. T. H. twin cylinder Magneto, driven by gearing from the crankshaft.

(Concluded on page 181)



The Bristol Cherub Flat Twin Aero Engine

What is the Matter with Commercial Aviation?

By William Knight, M. E.

IN 1919, Henry Bouché published in "L'Europe Nouvelle" an article under the title "The Government and the aeronautical industry" in which he said: "During the war the differentiation of aircraft and flying equipment has become more and more pronounced and has given rise to aircraft particularly adapted to a number of special services required of them, such as: day bombardment, night bombardment, escort for day and escort for night bombardment, observation, regulation of artillery range, infantry liaison, long distance reconnaissance, night reconnaissance, chase, chase at great altitude, night chase, patrol, coast line patrol, escort for convoys, etc., and all of these specialized services were the outcome of present day war requirements and, as such, were the outcome of the tactics of the great war, which will not necessarily be the same in another war.

Who can anticipate what will be the tactical requirements of another war in so far as aeronautics is concerned? Have we not learned during the last war that war tactics are formulated and modified at every instant according to the needs of the hour? If this is the case, we have no assurance at all that in another war we shall be able to utilize our present stock of aircraft and it would be dangerous for us to live under any such delusion."

I think that these remarks made by Henry Bouché a few months after the armistice were quite to the point and pointed out at that time a program of governmental aeronautical policies which after four years of aeronautical developments in Europe under Government control, defines just as clearly today as it was the case four years ago, the proper order of relation between the Government and the Aeronautical Industry which should have prevailed in Europe and in this country at all times during the last four years. At any rate, in so far as we are concerned, the last four years of operation of commercial aviation in Europe under the regime of government subsidies should teach us a good lesson.

The lesson that we must learn is this: To impose upon commercial aviation developments (design of aircraft, choice and operation of air lines, location of airdromes, etc.,) as a condition for obtaining a Government subsidy, restrictions aiming at an eventual mobilization of aircraft and aerial lines in case of war, is an error.

It is not in accordance with the best interests of any nation to create an aircraft manufacturing industry working almost exclusively on government orders and designing aircraft either frankly intended for military uses or else capable of being rapidly transformed into military aircraft in time of war.

This is detrimental to the interests of commercial aviation which has problems of its own, having very few points of contact with the problems arising from military and naval aeronautical tactics which must necessarily change more or less rapidly in time of peace and sometimes very rapidly in time of war.

Adverse Conditions That Aircraft Manufacturers Have to Compete With.

Commercial aeronautics instead, in order to be able to live a healthy business life must possess a character of permanency which is not possessed by military aeronautics and, for this reason, it must develop standard types of aircraft well adapted to the particular service that they are intended to perform (now and not in time of war) and must be able to produce a sufficiently large number of such aircraft in a minimum time and at a minimum cost.

As long as aircraft manufacturers are working almost exclusively on Government orders, according to government specification, and are building only a few aircraft of the same model, as it must necessarily be the case when building aircraft adapted to the ever changing requirements of the Army and the Navy, the manufacture of aircraft cannot be placed on a production basis, standardization of parts cannot be accomplished, the price of production must remain high and no aircraft manufacturer can afford to maintain a technical staff of engineers and designers always on the lookout for improvements in design and methods of manufacture leading to lower cost of production and more efficient operation of aircraft.

In this country where commercial aviation activities, with the exception of the Aeromarine Airways Co., and the U. S. Air Mail Service, are today almost at the same point where they were three years ago, commercial aviation offers no important market to aircraft manufacturers. The absence of a sufficiently large market for commercial aircraft, quite evidently, does not encourage aircraft manufacturers to design and to build commercial aircraft, especially not knowing what the demand for such machines is going to be when we will start commercial aviation activities. Shall the greater bulk of the demand be for passenger or else for freight carrying machines? Large machines or else small machines shall be most popular with aerial operating companies tomorrow?

These and a dozen more questions confront an aircraft manufacturer today who feels ambitious enough to design and to build a purely commercial aircraft for which there is no demand and that when it is finished costs so much that it cannot be sold. The result is that when once in a long while one of the so-called commercial aircraft are produced, they are more or less of a bad adaptation of a good type of military aircraft to commercial service, representing the best that could be done by the designer under the circumstances.

In other words, an aircraft manufacturer who does not feel justified in putting a good deal of money in the design and construction of an efficient type of commercial aircraft answering the requirements of a non-existent aerial operating company, (that he will have to guess about) simply makes the best possible adaptation of a military or naval type of aircraft, calls it a commercial aircraft and let it go at that.

Under such conditions as are prevailing at the present time, it would be hardly fair to blame aircraft manufacturers for failing to produce the types of aircraft that will make it possible to operate aerial lines on a paying basis. After all aircraft manufacturers are in the business for the purpose of making and not losing money and, if their only good customer today is the Government, a customer that knows exactly what he wants and is ready to give every engineering assistance to the manufacturer, why should aircraft manufacturers design and build at their own expenses and at their own risk commercial aircraft for which nobody knows the chief service for which they will be used when they will be needed?

Aeronautical Engineers, designers, experts on every branch of aviation, pilots, mechanics, skillful workers that have been trained during the war at a tremendously high cost have dropped out of aeronautics where no demand exists for their services. We will need them again in the future but most of them will not be available any longer and a large percentage of those available will have lost a good deal of their efficiency anyway, while others yet will be of little value when the time comes because they could not keep up with the progress that has been made in aeronautics during the last four years.

Aeronautical Engineers, designers and experts who could not find a job with the Government or else who could not afford to work for the Government on a pitiful government salary, have been absorbed in other branches of the industry and those who are working at present in the aircraft manufacturing industry are not supposed to have or to use much inventive ability, their job being to build military aircraft according to government specifications.

The Government is Doing the Work That Should be Done by the Industry.

Development research and experimental work which is the foundation upon which is built up the efficiency of any engineering and manufacturing enterprise, is in the hands of the government and is conducted in huge and costly engineering organizations run by the Government. The result of these prevailing conditions is that instead of training a competent staff of engineers and technicians in every aircraft manufacturing plant and depending on their ability and resourcefulness for developing new types of machines that will do the trick required of them and will pay dividends to the stockholders of the company that they are working for, we are developing a number of governmental aeronautical experts.

Are we best serving the interests of the nation by centralizing in the hands of the Government development and experimental work that could be performed by our aircraft manufacturing industry, especially at the present stage of development of commercial aviation? I do not think we are.

It seems to me that we are not so much interested in designing and building military and naval aircraft, as we are interested in building up a well balanced aircraft manufacturing industry capable of turning out to-morrow, in case of war, a large number of any desired type of aircraft which will be required at that time and at such low prices as it is possible to obtain only when standard manufacturing methods of production, standardization and interchangeability of parts have been developed by the Aeronautical Industry in peace time.

We all know that a modern war is a war of intensive industrial production requiring the services of armies of specialized workers in every branch of production, just as much (if not more) as armies of soldiers. We can safely predict that the next war (if there is going to be another great war) will be fought in the air and will be won by the nation that shall be able to win the supremacy in the air at the outset and shall be able to maintain it up to the end.

Quite evidently this object can be obtained only by the nation possessing the best organized aircraft manufacturing industry and the largest number of well trained flying personnel and not, by any means, by the nation possessing the largest military and naval air forces and a poorly organized aircraft manufacturing industry, when the war starts.

However this is the road that we have been travelling on since 1919 both in this country and in Europe. France has today the largest number of aircraft possessed by any nation in the world and has the largest number of aerial lines operated mostly by inefficient commercial aircraft (which however, in case of war can be rapidly transformed into military aircraft). Both the construction of aircraft and the operation of aerial lines (which have been selected in many cases for political reasons only, without any reference to climacteric conditions prevailing during a large part of the year and without any reference to the business available along the line) is costing the nation every year hundreds of millions of francs paid to aircraft manufacturers for building military aircraft camouflaged as commercial aircraft and for making good the losses of aerial operating companies which after four years of operation are unable yet to pay a fraction of their operating expenses.

On the other hand, in spite of the fine display of aeronautical activities in France and elsewhere in Europe, we must acknowledge the fact that neither France nor any other country has made any decided progress in scientific research work in aeronautics since the war, with the exception of the United States and Germany.

Why Germany Can Lead the World in Aeronautical Developments

It is painful to have to acknowledge it, but it is true just the same, that, of all nations, Germany is the only one that, if political and economical obstacles were removed at once, which are now preventing that nation from taking its place in the aeronautical field, inside of a very short time would lead the world in aeronautics.

Why is it so? Because Germany has kept together a nucleous of aeronautical Engineers, experts and specialists trained at the school of the war and, since the war, while other nations were building aircraft that in a near future will have to be thrown on the scrap pile. Germany has kept scientists and technical men busy at work solving the many complicated problems that must be solved in the selection of manufacturing methods in the use of aircraft materials and in the design and construction of aircraft, power plants and instruments that will make possible to operate aircraft in time of peace as a safe and efficient means of transportation and that, in time of war, will allow of a rapid industrial turn-over of aircraft and aerial equipment as it is needed.

We have seen in the late war that the great superiority of Germany in the first three years of the war was neither due to better tactical methods adopted by its generals (in fact the greatest tactical blunders were made by German Generals right at the outset of the war) nor to the superior military training of German soldiers. The great superiority of Germany over the allies was its magnificent industrial organization.

In every important plant in Germany that during the war was turning out aeronautical material, we find today a change in the production but we find in the shops the same foremen and as large a percentage of working personnel as it has been possible to retain under the changed production conditions. We find an aeronautical engineering bureau and an aeronautical research laboratory, and, judging by the activity of the work going on there you would not think that Germany has lost its wings.

Scattered all over the country we find attached to universities and technical schools a number of very important scientific research organizations working in close coöperation with former aircraft manufacturers. The German Aero Club, The Society of Aeronautical Engineers, The Aircraft Manufacturers Association and the Aero-Lloyd A. G., (this last being the world's most powerful combination of steamship lines, manufacturing organizations and financial interests backing an apparently inexistent aeronautical organization) closely coöperate with each other and with scientific research organizations, and are preparing the industrial machinery that will insure to Germany the dominion of the air in Europe, one year after the present obstacles are removed which are now preventing Germany from claiming its own place in the aeronautical field.

Aeronautical Governmental organizations, like the one at Adlershof that during the war was one of the most important centers of aeronautical engineering activities in Germany, are now all closed down and, for every practical purpose, the German Governmental aeronautical machine is shattered to pieces. Has this shattered to pieces aeronautics in Germany? Not by any means—in fact, aeronautics is much more alive today in the plans of the captains of German industry, in the Engineering bureaus and in the research laboratories attached to German manufacturing plants and educational institutions than it ever was in any other country, including our own, where the governmental machinery has remained intact and the aeronautical manufacturing organization has been shattered to pieces, and where the great bulk of business men have failed to realize yet the unlimited commercial possibilities of aeronautics.

What We Need Most is a Prosperous Well Balanced Aircraft Manufacturing Industry

As I said before, the interests of the nation are best served by encouraging in every possible way the development of commercial aviation in this country. In the meantime, however, we must realize that the foundation of commercial aviation is the commercial aircraft and we must direct all our efforts to the production of aircraft, power plants and instruments which will make possible to operate aerial lines as a paying proposition.

For this we need laws and regulation, this is understood, but we need most and primarily an aircraft manufacturing industry that will look upon aviation as a transportation service and not as a source of government jobs.

Military and naval aircraft bear the same relation to commercial aviation that battleships bear to the merchant marine. It would be an error to subsidize privately owned shipbuilding plants for turning out inefficient steamships for the purpose of being able to transform them in time of war into battleships.

The remark might be made here that it would be equally an error to depend on builders of merchant ships for turning out battleships in time of war. This is true, but the same criterion cannot be applied to the aircraft manufacturing industry. If our aircraft manufacturing industry is well organized for turning out in peace time standard types of commercial aircraft, in time of war it will be perfectly capable of turning out any desired number of military aircraft with some slight adjustments in its organization.

In the meantime what shall we do while we have no standard types of commercial aircraft and no market for such a thing? Shall we wait until Germany is in a position to sell to us at a low price good commercial aircraft, thus greatly injuring our own aircraft manufacturing industry? Shall we expect from our aircraft manufacturers to develop standard types of commercial aircraft and finance themselves the operation of a few aerial lines thus proving to the public that aerial navigation is both safe and practical? Shall we expect the public at large to invest their savings in aerial securities when we know that none of the aerial operating companies now in existence is paying its operating expenses?

I do not think that we can do much for solving all at once the various problems that commercial aeronautics is facing at the present time. All we can do is to recognize what we need and work in the right direction with the means at our disposal today. The main needs of today are: a federal aeronautical legislation, capitals, good commercial aircraft, and a well trained aeronautical personnel.

In so far as aeronautical legislation is concerned we are led to believe that we will soon see the beginning of some sort of action in the direction of establishing a Bureau of Aeronautics under the Department of Commerce which will make possible to submit to congress in a not too far distant future, a plan of legislation, which, we hope, will act as a spur and not as a brake on individual initiative. Let us keep in mind however, when framing any aeronautical legislation that will be submitted to Congress for approval that, up to a certain limit, government control is a necessity for doing business, and, behind that limit, government control is the surest way for paralyzing business. I think that Government control as applied to our railroads during and after the war and our recent attempts at government control of our merchant marine will admirably serve us for determining the critical point when government control ceases to be a blessing and becomes a curse.

We Need an Air Mail Service Operated by Aerial Operating Companies

To find out what the people want and to find out what is needed by business men, municipal and state governments in the matter of legislation in aeronautics is one of the most important functions that the National Aeronautic Association of the U. S. A. will have to perform. As long as this Association will be independent of any predominant influence exerted by either the Army, the Navy, Aircraft Manufacturers, politicians, financiers, pious or any other class of people or group of interests bent upon having commercial aviation in this country shaped according to their own pet idea of how it should be done, the National Aeronautic Association of the U. S. A. will be the connecting link between well balanced commercial, political and military interests in aeronautics and will be in a position to bring about the enactment of aeronautical legislation and the adoption of aeronautical policies by the government which will best serve the interests of the nation.

To lose sight of this most important function of the National Aeronautic Association would be a great error. To cater to any particular class or group or to be lead at any time by any particular group of people or interests to the adoption of a line of conduct by the Association which would bind it to the furtherance of the interests of any particular group would be the surest way to destroy the great prestige that has been gained in a few months by the Association, through the annunciation of a very broad and most comprehensive program of activities of which the keynote has been:—"Service to all."

Once we have adopted federal laws and regulations which will make possible to organize aerial operating companies and to fly all over the country under known uniform restrictions and uniform guarantees equally protecting the interests of both the public and the operating companies, capital will be attracted to commercial aeronautics in proportion of the present and future possibilities offered by aeronautics as a field of investment.

Like any other field of investment, aeronautics will not be able to win the interest of the public unless it has something real to sell. This something real and tangible can be offered only at the present time by the transportation of mail and parcels under contracts secured by prospective operating companies from the Government and express companies.

Quite evidently this is the point where the Government can and must help developing aviation. Contracts to properly organized aerial operating companies for the transportation of mail will have to be awarded under conditions which will encourage the establishment of aerial lines along routes where aircraft can successfully compete with other means of transportation. The transportation of mail and the guaranty of a minimum load should be granted by the Post Office Department to aerial operating companies only as a temporary measure for extending the help of the Government to such companies, which, due to the future transportation possibilities (of both passengers and merchandise) offered by the territory over which they intend to operate, and due to the type of aircraft intended to be used and the kind of terminal facilities secured by such companies, should be temporarily helped by the guaranty of a minimum volume of business enabling them to shift for themselves, with or without a government contract, in a few years time.

In other words, contracts to aerial operating companies for the transportation of mail should be granted not so much with a view of creating permanent air mail routes on lines where such service is needed as with a view of helping create commercial aerial lines for the transportation of passengers and merchandise wherever this method of transportation, in competition with or supplementing other means of transportation, offers a promising field of commercial activities, even if an aerial mail route is not a very desirable one at the time when operation starts.

Commercial Aviation and Subsidies

This, it might be pointed out, is a way of subsidizing commercial aviation, same as it is subsidized in Europe. To a limited extent this is true, although there is a fundamental difference between subsidizing aerial companies operating along lines which are not and will never be a field of revenue, (as it is done in Europe in a good many cases, for political and military consideration) and subsidizing commercial lines in this country along lines which are strictly commercial.

Besides this the guaranty of a minimum load of mail matter to American aerial operating companies does not need to be a subsidy. If a contract is granted to a company for the transportation of mail along a line where enough to make up the minimum load contracted for can be obtained, this is not a subsidy but is a payment for service rendered.

If a contract is granted to a company operating along a line where there is not enough postal traffic to complete the minimum load contracted for, it might be easily arranged that the difference between what represents payment for services actually rendered and the total amount paid by the Post Office Department would be reimbursed to the Government by the municipalities or the states being directly benefited by the establishment of aerial lines out of municipal or State taxes paid by the operating companies at such time when these companies will be on a self-paying basis.

The great weakness of the subsidy system in Europe is that it does not act as a stimulant to ever increasing independent business activities on the part of aerial operating companies, but it rather acts as a premium paid to them for abdicating their business judgment in favor of the political and military judgment of the government. The aircraft used are not the best adapted to the kind of service required of them, although they are entirely satisfactory to the Air Service (of France, for instance which pays 50% of the cost of aircraft and the balance of the unearned cost of operation of air lines amounting to between 80 and 90% of the total, according to figures recently published, covering the first eight months of 1922). There is entirely too much paternalism, too much Government control in aeronautics in Europe. Too much politics and too much militarism are mixed up with commercial aviation in Europe and this is the reason why aerial lines are yet unable to pay more than a fraction of their operating expenses after four years operation.

Under these conditions we fail to see where is the great superiority of Europe over the United States in the operating end of commercial aviation. We fail to see what is being done in Europe that we could not duplicate in a few months' time, provided that we were ready to throw away millions of dollars contributed by the taxpayers for the satisfaction of pointing out to a map of the United States crossed all over by black and red lines same as we see published every month in European Aeronautical Magazines. We have not much to show in commercial aeronautics, but what we have is fairly good. We have an aerial Mail Service operated by the Government which in 1922 has flown 1,755,556 miles, has transported 1,512,197 lbs. of mail and has cost us $1,421,419.08 to operate. It is not a wonderful performance by any means in a strictly business sense, but it is the best, the cheapest, the largest and the safest attempt to commercial operation of aircraft in the world at the present time.

What Aircraft Manufacturers Have Failed to Do

If however we can boast of our ability to transport the mail through the air at 6 cents per ounce actual cost of operation, during 1922, (which will be materially reduced when we will use better aircraft flying day and night) we must admit that besides producing some fine types of military aircraft, we have made very little progress during the last four years in the design and construction of commercial aircraft.

This is not surprising when we consider that out of $18,400,000 spent by the Army Air Service, during the fiscal year of 1922 only $5,233,634 went to the aircraft manufacturing industry for purchasing new aircraft, engines and accessories, while $8,300,000 were spent by the Army for expenses of civilian personnel, experimental and research work.

As I said before, we cannot expect aircraft manufacturers in this country to design commercial aircraft (for which there is no demand) out of the benefits of their government contracts; especially so when we consider the fact that, due to the small volume of business secured from the Army and the Navy, they cannot afford to maintain a sufficiently large engineering staff and can hardly do any amount of research and development work. As a matter of fact in a good many cases, due to a miscalculation of the cost of production and other reasons, a government contract has been the source of heavy losses to some of our aircraft manufacturers, which would have been avoided if they had been able to maintain an efficient engineering department.

On the other hand, however, we must admit that our aircraft manufacturing industry in general has taken a very mild interest in commercial aviation; has not done much to change the present situation and, therefore, in failing to help aerial operating companies to get started in this country, it has failed to help itself out of the present situation.

To put over commercial aviation in the United States is a matter of organization of efforts on the part of the Government, financial and commercial interests and the aircraft manufacturing industry. It is also a matter of salesmanship, because commercial aviation finally must be sold to the public.

The Press, and especially the aeronautical press, has quite an important part to perform in coordinating the work required for establishing commercial aviation on a sound business basis in this country. The aeronautical press is the logical medium through which manufacturers, aeronautical engineers, technical men, pilots and mechanics must be kept informed about the progress of aeronautics throughout the world. The aeronautical press must be able to convey to business men exact data and information about aeronautical possibilities and limitations arising from the operation of aircraft, and finally, the aeronautical press is the agency that must ultimately sell aeronautics to the public.

Aircraft manufacturers, in my estimation, have not given to the aeronautical press the support and the collaboration which it was fair to expect of them—this work has been carried on so far by publishers and editors of aeronautical magazines for the love of the game only, which is not fair. There is a great deal of educational and organization work to be performed yet in aeronautics and on a much broader scale than it is done at present by the aeronautical press. Publishers and editors of aeronautical magazines are ready to continue doing their share to the best of their ability; they have a right, however, to request that the aircraft manufacturing industry in this country take a greater share of responsibility in the maintenance and the development of the aeronautical press.

Another point on which aircraft manufacturers have partially failed to contribute their share to the development of civil aviation is in the matter of establishment of flying schools and in the organization of joy rides for the public at large at such prices that would encourage any young men to become fliers. The charges made for this sort of series in most of the few places where it can be obtained at present is entirely too high and cannot be justified in the name of business efficiency. I understand that engineers, designers and other technical employees of aircraft manufacturers who are running a flying school must pay for being instructed in the art of flying—most of them cannot afford to do it and consequently, are prevented from acquiring a much needed, more intimate knowledge of machines that they have to design and construct. If this is true, it looks to me like a rather cheap policy.

Also, the Aeronautical Chamber of Commerce, which was organized one year ago and the newly organized National Aeronautic Association of the U. S. A. offer to aircraft manufacturers two very efficient means for furthering the interests of commercial aviation. Both of them, however, in order to be able to do good work must depend on the most earnest cooperation, financial and otherwise, of aircraft manufacturers.

In conclusion, I think that our aircraft manufacturers do not deserve to be blamed for having failed so far to develop standard types of commercial aircraft for the specialized commercial aviation services which will be required in this country. They do deserve, however, to be blamed for having failed to do much in the last four years for removing the causes which are hindering commercial aviation activities in this country—they have been, generally speaking, (with a few exceptions) satisfied with large and small government contracts, without seeming to have much faith in commercial aviation. Their stand on the matter of commercial aviation during the last four years has been just about this: "If the public and the government want commercial aviation in the United States, let them get busy and organize aerial transportation services and we will sell aircraft to whoever wants them and has the cash to pay for them. Of course we cannot sell them as cheap or as good as some foreign countries (Germany, for instance) but both the government and the public will have to pay the price for establishing a manufacturing industry which is essential to the national defense."

Need for Research and Development Work in Manufacturing Plants.

And it is quite true that our national defense depends to a very far extent on the establishment of a powerful, efficient and well organized aircraft manufacturing industry, and not on any number of military and naval aircraft that we might build in peace time. At the present time when the Government is practically the only customer of our aircraft manufacturing industry, the policy should be adopted of reducing to a very minimum the engineering, development and manufacturing work in aeronautics which is done now in Bureaus and plants owned and operated by the Government.

Really there is no need for such work being done by the Government and there is every need for turning this work over to the aeronautical industry that needs money and experience. Of course there is a certain amount of work of a purely military nature which must be secretly done by the Government. But where no military secrets are involved there is no reason why this work could not be performed by the industry.

Purely scientific research work such as is done by the National Advisory Committee for Aeronautics and other Governmental agencies is better performed under Government control rather than under the control of aircraft manufacturers. This however, does not mean that all scientific work should be performed by the National Advisory Committee for Aeronautics. On the contrary it would be very much desirable to have an aeronautical research laboratory built at every important aircraft manufacturing plant. It would be a good plan to appropriate enough money for scientific research work (about ten times the present appropriation of the National Advisory Committee) and authorize the Committee to build wind tunnels and other testing equipment right in the plants of aircraft manufacturers.

Aircraft manufacturers would pay for the ground and for the running expenses of the laboratories where scientific research work would be done under the supervision of the Committee. In this way we would secure a much needed unity of program in aeronautical research work, which at the present time is done in a dozen laboratories working independently one from the other, and at the same time we would educate aircraft manufacturers and aeronautical engineers to the importance and the practical meaning of scientific research work—and God knows that they need badly to be educated along this line.

The same criterion applies to research and development work of instruments and power plants for aircraft which is now being done by the National Advisory Committee for Aeronautics, the Army, the Navy and the Bureau of Standards and which could be very well done by the industry under the supervision of the National Advisory Committee for Aeronautics.

In other words what we need in scientific research work in aeronautics is an organization exclusively in charge of this work which will act as the clearing house of all demand for this kind of work, from every department of the Government and from every branch of the industry that will apply to this organization; the actual work being done in the various laboratories operated by the aeronautical industry under the general supervision of the Government.

The Government Should Not Compete With the Aeronautic Press.

As a matter of fact, scientific research work is not the only field of Government activities where the need is felt of a more businesslike organization of government services and less government management of activities which are better performed by the industry. Before the war this policy was the keynote of our democratic form of government. However, since we went to war against Prussianism, somehow we have become infected with the disease.

In aeronautics, what we certainly need is the elimination of a good deal of unnecessary overlapping and duplication of efforts in the various departments interested in aeronautics and the elimination of a good many governmental organizations which are performing a service that could be more efficiently performed by the aeronautical industry, under the general supervision of the Government. In other words we need to start a centripetal movement of unification of aeronautical services scattered into three or four Departments and Committees and a centrifugal movement of reorganization which will throw out of the Government every aeronautical service that can be absorbed by the national industry. Let us keep in mind that our aeronautical problem is one affecting both the national defense and the industry of the nation at the same time and that we cannot separate these two aspects of a problem that is essentially one.

The publishing business is another field of aeronautical activities where the cooperation of the Government is needed and where the competition by the Government is very undesirable and quite unnecessary. Aeronautical bulletins, reports and other publications which are now edited by the Army, the Navy and the National Advisory Committee for Aeronautics (the latter only spent $35,825 during the fiscal year 1922 for editing reports and technical notes) could be very well edited by the aeronautical press for the same amount of money that is now spent for editing them as special publications of various aeronautical departments of the Government.

The present circulation of these reports is necessarily limited and only some of them are reprinted by aeronautical magazines reaching the public at large. Would it not be better in the interest of aeronautics to publish in aeronautical magazines all non confidential aeronautical reports and bulletins now edited by the National Advisory Committee for Aeronautics and other departments of the Government?

A move such as this, besides increasing the usefulness of government publications would also increase the circulation (and consequently the volume of advertising business) of aeronautical magazines and would enable publishers and editors of these magazines to do more for aeronautics than they are doing at the present.

The National Aeronautic Association Should Take Up the Matters of Standardization.

In the meantime however, let us do two things that we need most at the present time: let us develop our present Air Mail Service (always with a view of decentralizing this service as soon as possible and let aerial operating companies take care of it) and let us tackle the problem of Standardization of parts entering into the construction of aircraft, insofar as it is possible at the present time.

There are a number of parts entering in the design of present day aircraft and aero engines which do not need to be a special job for any new type which is designed, and a good many others, with little effort made in a spirit of cordial cooperation between those interested in this matter, could be standardized for the time being.

In this matter, everybody is interested and every organization interested in aeronautics is doing something in the right direction. The only trouble is that there is not one single organization that is making its business to coordinate the work of all and get some sort of action acceptable to all.

This, it seems to me, is another job and a mighty important one that should be tackled by the National Aeronautic Association of the U. S. A. which for this purpose should invite the cooperation of the National Advisory Committee for Aeronautics, the Aircraft Manufacturers Association, the American Society of Automotive Engineers and the American Society of Mechanical Engineers, in formulating a

(Concluded on page 185)

Airway Landing Fields

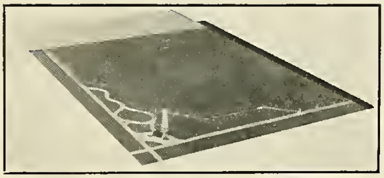
By First Lieut. C. E. Crumrine—Army Air Service

An Airway is an organized chain of airways landing fields that are known terminals, sub-stations, intermediate stops, and emergency landing fields. It serves as a highway for airplane travel.

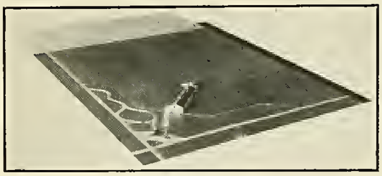
Airplanes are an essential factor in speeding up business—the business of commerce and war. Once planes are off, they will travel a given distance in one-half the time required by the fastest trains. Getting the plane underway is one of our greatest problems—so much time is lost in housing, repairing, and fueling the plane, and in obtaining the exact weather reports, that sometimes very little time is gained by air travel.

The United States Army Air Service has undertaken the task of organizing an airway which will cure these evils.

If the reader is in any doubt as to the necessity of organized airplanes, let him make two long trips by air. First over an unorganized route, such as we have on a direct line from Dayton, Ohio, to Charleston, S. C., a distance of 550 miles. The start is made—after flying 200 miles, his gasoline runs low—he must look around for an available landing space and pass through the uncertainty of finding one at all. Finally an open lot is sighted, and with great relief a landing is made. The plane is rolling to a stop, when one wheel drops into an unseen hole. A sharp turn results and a tire blows out. No shops handy—a long trip to town—repairs slow and tedious. Then comes the fueling—gas and oil of an uncertain grade must be transported to the field. The day is now nearly spent, so the plane is left in the open exposed to the weather, and the tired traveler lays over for another day. The next day, the same process is repeated and at the end of a third day



Landing field with beacon tower and border lights added

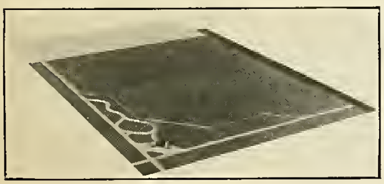


A hangar has been added

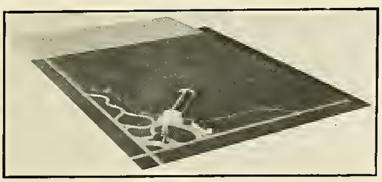
he arrives at Charleston, having consumed much time and considerable nervous energy.

Now let us go over the second route—an organized one—New York to Dayton, Ohio, via Washington, D. C., a distance of 620 miles. At 8:00 A. M. we leave Mitchell Field, the Long Island Air Terminal. With a plane well groomed, accurate weather report maps and guide books at hand, the start is made. Every 25 miles a well marked emergency field is sighted. At Pine Valley, N. J., an intermediate stop for ten minutes—then on to Bolling Field, the Washington Air Terminal. Here efficient mechanics inspect and fuel the plane, weather reports are obtained, and in 30 minutes we are under way. Another intermediate stop at Cumberland. Plane is again refuelled at Moundsville, W. Va., (sub-station). Off in 20 minutes. Next landing Columbus—intermediate stop—and at 4:00 P. M. we glide into McCook Field, Dayton Air Terminal. Total elapsed time 8 hours: the best train from New York to Dayton requires 17 hours.

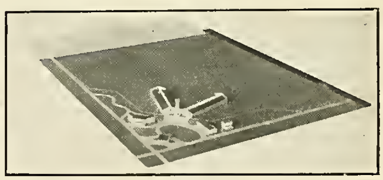
Because of the time and money involved the Air Service is adopting the Thies progressive landing field program. The attached photographs serve to illustrate this program, which will be given its first trial at Columbus, Ohio.



Landing field with gasoline and oil station



A shop has been added



The completed station including shops, garage, and club-house

(*Concluded from page* 168)

tions must accept the best verdicts of the day, work out their decisions as carefully but as rapidly as possible, and shape their programs accordingly.

Aircraft as a comparatively new element in national councils is subject to considerable polemic discussion; some experts ranging themselves bitterly against it and others equally enthusiastic for it. However, all policy must in the long run accurately reflect the great body of public opinion. Aviation activities all over the world are undeniably popular and seem to denote that public opinion is squarely behind the whole policy. This is particularly true with reference to civil aviation developments.

As the public begins to realize more that in any future conflict, aviation must be depended upon to defend the civilian populations in their homes as well as help fight an enemy on their borders or abroad; a sound and definite aviation policy will be adopted. Such a policy, well formulated, will everywhere command and receive the support of intelligent public opinion and will in time become an integral part of the national consciousness.

(*Concluded from page* 176)

Mixture is provided by a Zenith carburetor, drawing hot air from the exhaust pipe.

This engine is a really sound practical job, which will stand up to any amount of hard wear, and will give continued satisfaction.

A small production batch of these engines is now being put through the shops, and those interested in this type of engine should send further enquiries to the Bristol Aeroplane Company, Ltd., Filton, Bristol, England.

Reed One-Piece Solid Metal Semi-Flexible Propeller

A semi-flexible, solid, thin one-piece metal propeller, of about the same weight as a wooden propeller, which can be twisted to varying pitches and twisted back again, permitting combinations of 2-bladed propellers to make fours at will, turning at the velocity of sound, may cause many changes in design and new records for speed and weight carrying. General reduction in propeller diameters may result. Suitable for the everyman low-powered low-priced airplane. New propeller will be geared up instead of down. It may lower the power plants of seaplanes and boats and raise pontoons or land gear.

THE highly interesting new propeller of Dr. S. Albert Reed, of New York, is to be marketed by the Curtiss Company. After eighteen months of experience since first flight tests, a number of his novel propellers are in flight service on engines varying from 90 h. p. to 200 h. p. and forgings are now available for 400 h. p. Liberties. The Navy has ordered six 200 h. p. Hispano propellers, five have gone to McCook Field for various tests and preliminary tests have been made abroad by the French and British air services. Three of the Dayton propellers are for high speed planes, and one of the propellers is expected to fly with a tip speed of 1100 ft. per sec., a record. Tests thus far made prove, Dr. Reed claims, that his novel screws are the most efficient in service today, giving a material gain in flying speed for any stated power over any other propellers now known.

Air Reactions to Objects Moving at Rates Above the Velocity of Sound With Application to the Air Propeller

By S. Albert Reed, Ph. D.

IN the course of experiments conducted during the year 1916 regarding acoustic pitch of high frequency, it was found necessary to use an apparatus with arms radiating from a hub and rotating at a very high rate of speed. In an effort to reduce air resistance it was discovered that the arms could be made quite thin and sharp at the edges and still have sufficient strength to withstand centrifugal force.

It was further observed that, through centrifugal force, the arms possessed sufficient rigidity to resist stresses which existed tangential to the circles described by the tips of the blades.

This, naturally, led to the consideration whether a twist (warping) or inclination (pitch) of the arm-blade from the radial plane could be maintained, the arms then acting as blades of a propeller. It developed that with the proper shape and proportion a twist or warp could be maintained with reasonable constancy making it evident that I had, perhaps, discovered an elementary air screw or propeller adapted to very high speeds.

Investigations pertaining to the usual type of propeller disclosed that up speeds seldom exceed 90 feet per second and that the only recorded attempts to explore the higher speeds appeared in a paper issued by the British Advisory Committee for Aeronautics, March, 1919. At this time a tip speed of 1180 ft. per second was reached with a two-blade 9-foot propeller, the observations revealing that, "as the tip speed approached the velocity of sound the usual air flow breaks down entirely, the slipstream rapidly diminishes and ultimately disappears; the air apparently being sucked in on both sides of the disc and exhausted at or close behind the periphery when the velocity of sound is reached."

There has been a tradition general among aeronautical engineers that a critical point exists for tip speeds at or near the velocity of sound, indicating a physical limit in the use of propellers at higher tip speeds; the idea being that something would occur analogous to what is known in marine propellers as "cavitation." Being unable to find a verification of this tradition or a record of experiments along this line, other than the British paper quoted, it appeared that this field had been practically unexplored.

With the new type of blade, described in this paper, it is evident that other and more extensive experiments are possible and that the validity of the existing belief can be tested. It also appeared, in reference to the air resistance of projectiles, that there was supposed to exist a critical point in the plotted curve of speed and resistance at velocities between 1100 and 1200 feet per second. *In the examination of the physics pertaining to both propellers and projectiles moving at or above 1100 feet per second, the conclusion was reached by me that there is no reason for the existence of such a critical point and that, if it had been noted by observers it was not inherent in the phenomena revealed, but rather due to a particular shape or proportion of the projectile and that, with properly proportioned sections, it would not exist.

Berthol. "Guns and Gunnery."

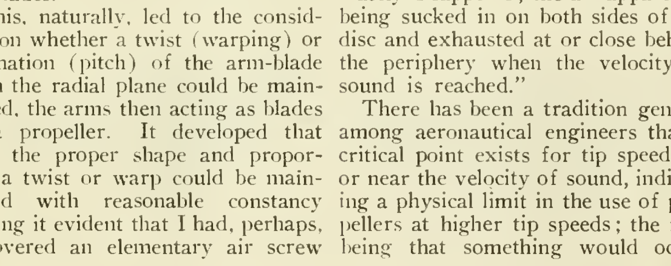


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Fig. 1—Reed dinalumin propeller D-4 mounted on Curtiss JN with Ox5 engine

*Experiments were then begun with thin flat blades of aluminum constructed with sharp edges and set at various angles of twist or pitch up to 45 degrees, and with tip speeds from 700 to 1550 ft./sec.

Series 1. This series was tested in the author's laboratory with a 10 h. p. electric motor at 1150 r. p. m. geared to propeller shaft in ratio of 12.25 to 1, producing a shaft speed of 14,088 r. p. m. or 235 r. p. s. Aluminum propellers of two blades measuring two feet from tip to tip were used, with provision for measuring speed, thrust and torque.

Series 2. This series was made

and tested under the author's directions by the engineers of the Curtiss Aeroplane and Motor Corp., at their factory in Garden City, L. I., N. Y. A 100 h. p. aircraft engine at 1500 r. p. m., capable of running at 1800 r. p. m. was used. The gear ratio was 4 to 1, producing a propeller speed of 100 r. p. s. Aluminum propellers measuring 4 feet from tip to tip of blade were used, propellers having 2, 4 and 6 blades of various shapes and proportions, all blades being so thin as to make them devoid of sufficient structural or inherent rigidity to withstand more than a fraction of the stresses of operation, relying mainly upon the virtual or kinetic rigidity due to centrifugal force.

Series 3. Propellers installed on standard well-known types of airplanes and subjected to rigid tests under actual flight conditions.

Discussions

From the well-known formula for centrifugal force it is easily ascertained that, with a velocity of 1500 ft./sec., the radial tension at the tips, in this case, is increased about 32,000 times, i. e., one ounce at the tip produces a radial tension of one ton. With a deflecting force on the whole blade of not over 100 lbs., parallel to the shaft, there would be but a slight flexure, thereby permitting the use of thin blades with sharp edges and a minimum contour, without the danger of rupture. Furthermore, as a matter of convenience and simplicity in manufacturing for testing purposes the boss very plainly can be made quite unlike the helical shape of the regulation propeller as will be seen further on.

Numerous mechanical devices were designed to meet the rather unusual requirements of enormous rotational speed, high power and the necessity of obtaining accurate measurements of thrust and torque.

* * *

The shaft was equipped with a flange which operated against ball bearings, the latter running in a concave receptacle attached to a hinged lever. The free end of this lever was connected to a spring scale, providing a means by which the thrust was measured.

* * *

In order to ascertain the torque stresses in the countershafts intervening between the engine and propeller, measurements were made by the use of an extended arm in accordance with the principle of the well-known transmission dynamometer. The torque of the frame or box, carrying those countershafts, had a certain fixed ratio to the h. p. being transmitted, making it possible to get a very accurate reading.

© U. S. Army Air Service
Fig. 2—Reed propeller D-6 mounted on a Curtiss Oriole

* * *

In Series 1 experiments were made with 22 and 17-inch propellers given in Fig. 3, the 17-inch being simply a 22-inch propeller with the blades cut off 2.5 inches.

* * *

It is quite apparent from the results obtained in the experiments above and with a two-blade, 4-foot propeller of Series 2, that the ratio of thrust to tip speed undergoes an appreciable variation when exceeding the velocity of sound or even to an excess of 50 per cent in velocity, and that the physics in the problem reveals nothing that would deter the operation of propellers at tip speeds far greater than those heretofore considered possible. The failure of the British experiment, previously referred to, was due, no doubt, to the air turbulence and other disturbing factors resulting from the use of blades not adapted to high speeds.

* * *

From the results in a series of experiments in the region of velocities from 700 to 1400 ft. p. s. with the 22 and 17-inch propellers at 0° pitch, it will be noted that there appears to be no critical point or sudden turn in the plotted curve at or near the velocity of sound.

As to the rate of rotation to velocity, the frequency of the air impulses from one blade of a 2-bladed propeller at 100 r. p. s. is about equal to that of the 3rd F, reaching the middle octaves of a piano. The tone emitted by the 2 and 4-foot propellers when absorbing 100 h. p. is clear, sharply definite as to pitch, and of great intensity, being audible for several miles. The tone is very similar to that of a powerful steam siren and has none of the confused and distressing violence claimed in the British experiment.

The standard 2-blade propeller, of the usual character, when mounted on an aircraft engine with the customary speed of 1500 r. p. m., gives rise to air impulses reaching the ear at about 40 per second, no greater than the lowest base note of a piano and is, therefore, generally not clearly perceptible, as a definite musical tone, mainly because of its depth of pitch. It is also of the same frequency as that of the tone of an 8-cylinder exhaust, but the latter, being more powerful, remains the predominating sound.

Very high speed propellers have an unusual note of great penetration, quite distinct from the roar of the exhaust. Important usage had been made of this tone in experiments, by which it was possible to determine speed and a verification of tachometer readings.

The success of these experiments is due largely to the efficiency with which the profiles were designed in order to get stability of pitch, stabili-

© U. S. Army Air Service **Fig. 3—Propellers 22 and 17 inches long**


© U. S. Army Air Service
Fig. 4—Reed 8'7" propeller 5/8" thick at hub section; 1/8" at top section; made of a single piece of sheet metal 5/8" thick

ty against fluttering and also against segmental vibration under the action of enormous centrifugal force.

In these designs the resultant of axial, radial, tangential and torsional stresses on the blade at full speed gave a close uniformity of load distribution, the blades, therefore, not vibrating either as a whole or segmentally. If such vibrations do occur, due to an improper form, the thrust diminishes perceptibly, as seems to have been the case in the British experiments, the absorption of power may increase rapidly and become excessive while the sound emitted may be of a most disagreeable character.

With the proper form the thrust and torque progress steadily and in a constant ratio, and the sound emitted is a clear, definite, simple note, the pitch being easily determined by comparison with a suitable tuning instrument.

In order to ascertain the performance of a propeller in actual flight, and owing to the diameter of the propeller making it too large for the wind tunnel, the Curtiss company anchored an airplane immediately in front of the propeller erected for test. The airplane propeller was driven by its own engine and delivered a slip stream parallel to the slip stream of the propeller under test—the wind being controlled to some extent by screens—at an average velocity of 41.9 m. p. h. as indicated by a Pitot tube. The results obtained from this method, although reasonably substantial, are not considered as having the accuracy of those of wind tunnel tests.

* * *

Referring to Series 3, the practical test, nine different propellers were made and used on airplanes in flight; one, the D-4 on a Curtiss JN, OX5 75 h. p. engine, Fig. 4; another, first on a Curtiss standard K6 150 h. p. engine, and afterward on a Curtiss Oriole, 160 h. p. engine, Fig. 2; two others on Curtiss Orioles, and one on an Air Mail 400 Liberty engine. In the first four cases my propeller proved the more efficient when compared with a wood propeller, while with the Liberty engine the pitch being purposely too low for full speed, the flight was made with engine throttled, the propeller turning at about 1900.

The D-1 and D-2 were tested statically at McCook Field and proved a success. D-1 had been flown several times on a 160 h. p. engine and also endured a 30-hour test successfully. The D-6 was flown a number of times, twice with a passenger, attaining an air speed of between 106 to 108 m. p. h., the usual wood propeller accomplishing a speed of 96 m. p. h. It was again flown on an Oriole, in a race during the Spring meet at the Curtiss Field and won easily against several competitors. It was then given to Amundsen for an Oriole taken on the Arctic expedition. Another propeller, D-8 was tested to destruction at McCook Field in order to determine the maximum blade width in the tip region which a blade of certain root thickness can sustain without oscillation of pitch, or fluttering under the stresses for which the propeller is designed. Tests were also made with a 50 per cent additional overload as required in Government tests. The speed was increased until the pitch broke down, causing violent fluttering which eventually resulted in fracture. With the data thus obtained the maximum power absorption can be determined and when the propeller, so designed, is subjected to test and found to maintain its pitch steadily, it can be relied upon as proof against fracture in service.

The D-26 propeller, 7-foot 9-inches in diameter, with a 9-foot 6-inch pitch, designed for the Curtiss Army racer for the Pulitzer trophy, was tested statically at McCook Field in October, 1922, to over 2300 r. p. m., absorbing 639 h. p. without flutter and without deformation.

In the proportioning of stresses exerted on the blades, in order to maintain the required pitch, there are involved calculations and formulae which differ in some degree from those used for wood propellers, necessitating a departure from established precedents. There is no doubt, however, but that propellers of this type can be adapted for use up to the highest powers and speeds; in fact, at the present time, they are probably superior in efficiency to any other. Being made of solid duraluminum, or an alloy with similar physical properties, and in a single piece, they have no hollow space, weldings or rivets. The weight is almost the same as that of a wood propeller of the same area; and while the advantages of metal over wood are generally accepted, its superior aerodynamic properties are still the prominent and essential factor. This latter feature is due to the thinness of the blades, the use of which without deformation under conditions of service, has been made possible in the Reed propeller.

This propeller may be classed as semi-flexible. It is made of rolled sheet metal 5/8" to 1" thick, annealed, and cut to the desired shape. The tapering in thickness is begun a short distance from the hub center and is continued straight to the tips, at which point the thickness is from 1/10" to 3/16". The back surface of the tapered position is cambered, producing an approved airfoil section, at least, from the 30" station out, with lower surface flat and upper surface cambered. The blades are twisted to the proper pitch and heat treated, after which they are drilled to admit the propeller shaft and then mounted, either on one of the regular wood propeller steel hubs by means of a filler block, or on a specially shaped steel hub, as shown in Figs. 4 and 5. The propeller is then rigid at the center and progressively flexible toward the tips.

In order to further present the theory of this propeller, attention may


© U. S. Army Air Service
Fig. 5—Reed propeller with boisted flange hub

be given to Fig. 6, in which the approximate profiles of a typical wood propeller and that of the Reed propeller at the same radii are given, the peripheral speeds in ft./sec. for an 1800 r. p. m. being:

Radii:	6″	12″	18″	24″	30″	36″	42″	48″	54″	60″
F. P. S.	94.2	188.4	282.6	376.8	471	565.2	659.4	753.6	847.8	942

The performance of airfoils is generally assumed to agree with the results obtained in wind tunnel experiments which have been made up to 250 ft. p. s. only, with interpolations for greater speeds up to 900 ft. p. s., the latter being accepted without question, although based upon assumption. In considering speeds which approach the velocity of sound there is reason, however, for not relying upon interpolation, the indication from results for speeds approaching 1100 ft. p. s. being that there is no longer only the increase in pressure on the rear surface and a diminution on the front surface, both contributing to a useful thrust, but also a pressure wave which accumulates around and on both sides of the leading edge and a similar rarefaction wave at the trailing edge.

These pressure waves spread forwardly as well as aft in relation to the course of the airplane, and, therefore, not contributing to thrust, absorb and waste power. As affecting the velocity of bullets, Professor Boys' photographs of bullets in flight, made first in 1893 and described in "Nature", March, 1893, and also in Smithsonian Institution reports of 1893 (similar photographs are now being made by Major Wheelock at the Frankford Arsenal) throw much light on this subject, demonstrating that slowly-moving bullets, having a speed of not over 800 ft. p. s., may have quite a blunt nose without creating a compression wave; but as the velocity approaches and exceeds 1100. ft. p. s., the compression waves become the chief consideration, and are reduced only by the use of a sharp nose, or a small angle, and a cut-away tail. In the Reed propeller the blade sections up to approximately 36″ from the hub center, travelling at about 600 ft. p. s., could, therefore, have reasonably thick sections with blunt edges, but beyond this station the thinness of profile and sharpness of edges becomes a very material factor; and in the eight or ten inches of the tip, a portion which contributes largely to thrust, it is a matter of serious importance whether or not the leading edge is blunt or sharp, and with a low angle of edge.

Another advantage, by no means negligible, is afforded in the Reed propeller, in the thrust created by the profiles toward the root of the blades. Although comparatively small, this portion contributes to thrust and also produces a cooling *blast of air against the nose of the fuselage, which is very serviceable when a radiator is used at that point. The profiles in this portion of a wood propeller, as shown in Fig. 6, are thick, and poorly-shaped serving more in the capacity of strength, and do not create enough thrust to even carry their own weight. It may, therefore, be theoretically concluded that the higher efficiency of my propeller is due somewhat to the structure at this point, the determinations, based on experiments, indicating that the net average advantage gained is at least 6 per cent. Considering radial tension as existing specifically in the Reed propellers on account of centrifugal force; calculations reveal that under a speed of 2000 r. p. m. the tension does not exceed 8000 lbs. per square inch of section, and moreover, under 3000 r. p. m. the tension does not exceed 60 per cent of the breaking strain claimed for the material. In the matter of pitch constancy when properly proportioned the propeller will maintain its pitch under a power absorption of 50 per cent in excess of that for which it is designed. Other features of value, not contained in the usual wood propeller, will be readily appreciated, i. e., the pitch is adjustable, and on account of the ductility of the material, the blades can be twisted back and forth a number of times without injury to the material until the desired pitch is obtained. Furthermore, in the case of accidents, causing a moderate deformation, it is possible that the original shape may be completely restored. Still another feature, made possible by the thinness and flatness of the blades at the root, is that by crossing two-bladed propellers, a four or six-bladed propeller is easily provided, or, if preferred, two or more can be mounted in tandem.

* * *

*Readers will recall C. M. Olmsted's propellers designed to salvage thrust at the root.—Ed.

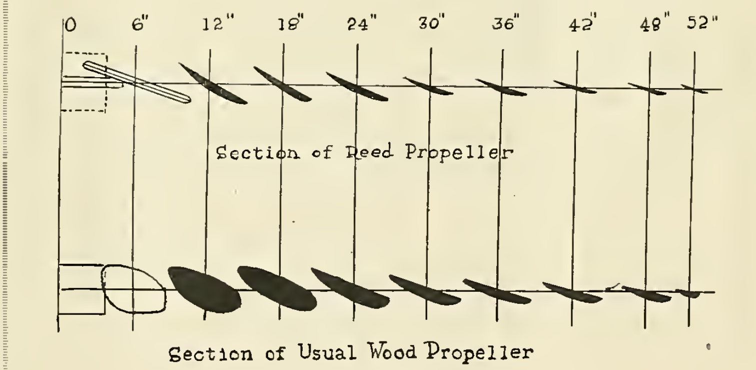

Fig. 6

(*Concluded from page* 180)

program of Standardization in discussing it and adopting it. As long as nobody takes the initiative in originating a movement on Standardization of parts entering in the design of aircraft and aero engines, commercial aircraft cannot be designed, built and repaired at such prices that will make possible the operation of aerial lines on a business basis.

Of course it is not required that the National Aeronautic Association of the U. S. A. should issue Standards. This is not one of the functions of the Association, at least for the time being. But it is very much one of the functions of the Association to act as the connecting link between the many (and sometimes conflicting) interests that will have to be harmonized in order to "Make America first in the Air", which is the proud motto adopted by the Association. To sponsor and to promote the adoption of Standardization, to make a study of the kind of legislation that must be submitted to Congress for approval, and to take an active interest in bringing about the adoption by the Government of a policy of centralization of necessary government services and decentralization of other government services that can be absorbed by the Aeronautical industry, seems to be a good beginning of the many useful initiatives that everybody confidently expects from the National Aeronautic Association of the U. S. A.

An Open Letter to the Members of the Sixty-eighth Congress

Outlining the Duty of Every Congressman Who desires to Have the United States Retain its Proper Place in the World of Aeronautics

By Douglas Wardrop

Gentlemen:

In the life of a nation, as in the life of a man, a moment comes when a certain situation arising from a number of accumulated causes must be faced and an issue must be found.

The moment has come when we must face the critical situation of aeronautics in this country, investigate the causes which have made possible prevailing conditions and put life, order and efficiency in one of the most important branches of our industry, our commerce, and our National Defense.

We have the greatest confidence in the wisdom and in the patriotism of the Sixty-eighth Congress; we have the most implicit faith in the future of aeronautics and therefore we do not hesitate to undertake the unpleasant task of bringing to the attention of all of you, gentlemen, a few cold facts and comments on the present aeronautical situation in the United States which demands action from you for the good will of the nation.

We fully realize that some truths and comments that we will have to bring to your attention in the course of our campaign will strike a very unpleasant note in some aeronautical quarters but we believe that the function of honest journalism is to speak the truth and this is what we propose to do to the best of our ability.

Gentlemen, the truth of the matter is this:

1st: We need federal laws and regulations in aeronautics equally protecting the interest of capital invested in aeronautics, the interests of the public that will have to use aircraft, and the interest of the Government that *must* depend on aeronautics in every national emergency that may arise in the future.

2nd: We must eliminate a good many government services which are doing a kind of work that must and can be taken care of by the aeronautical industry, and are duplicating in two or three departments and committees the same work.

3rd: We must have a reorganization of all aeronautical services affecting the National Defense, leading to the recognition of the fact that aeronautics is not a side issue with either the Navy or the War Departments but is a very vital matter for the future of this Nation of ours and is important enough to demand the creation of an Independent Air Service amalgamating the needs of both the Army and the Navy in so far as aeronautics is concerned and furthermore, amalgamating the interests of the aeronautical industry and the interests of the government at the same time.

4th: We must develop our aeronautical industry, which is in such a shape that if we continue our present aeronautical policies, will be dead in a very short time.

Gentlemen, if we had to-day 10,000 military and naval aircraft supplied by a poorly organized and anemic aircraft manufacturing industry and no pilots to man them we would be in a deep hole if a war should break out to-morrow, while instead, if we had only 500 or less military and naval aircraft and thousands of commercial aircraft manned by civilian pilots and built by a prosperous aircraft manufacturing industry well organized and on a production basis, we would have the pilots and the fighting machines when needed and such as are needed, when the time comes.

5th: In spite of the many world records that we won last year, in spite of the sensational cross country and trans-continental flights that have been made by our gallant Military and Naval pilots, in spite of the fine performance of our air mail service (operated by old worn out types of aircraft) do you know, gentlemen, that we have not a completely dependable power plant for aircraft and commercial aircraft that would be considered as a good risk by any insurance company and would pay dividends to an aerial operating company? Do you know that in spite of the hundreds of millions of dollars that we have spent for military and naval aircraft in the last few years we have failed to offer a competitive prize to the aircraft manufacturing industry for developing a safe type of commercial aircraft, a dependable power plant and a few navigating instruments that are sorely needed before we can honestly demand the public at large to trust their lives and their money in aeronautics?

Gentlemen, the main present day problem in aeronautics is to create a huge military and naval aeronautical organization.

No money should be spared by the Government for creating the conditions whereby our aeronautical industry can grow and aerial operating companies can be organized in this country on a business basis and not as so many liabilities, as is the case in Europe.

In order to do this the first and the most important step to take is to adopt such laws and regulations as are needed, with as little of governmental control on individual business initiative and a generous inducement to capital to find a profitable field of investment in aeronautics as it is possible and expedient to do.

Next step must be to put commercial aeronautics under the control of the Department of Commerce (and not under the control of the Army and the Navy) and to put both the Military and the Naval Air Services under the control of a single department of National Defense amalgamating the needs of both departments and closely cooperating with the aeronautical industry through the Department of Commerce.

Third—Let us spend all the money that is needed for encouraging the development of good standard types of commercial aircraft right in the shops of aircraft manufacturers and not in government plants. Let us spend all the money that is required for scientific research work leading to the creation of safe, cheap and efficient aircraft and let us build them, hundreds, thousands of them, with government money if necessary, for every army racer or bombing machine that we *must* build, and let us use them for carrying the mail all over the country, even if it costs twice as much as it costs now to carry the mail by rail; let us use them for fire patrols and for patrolling our sea coast. Let us use them for every possible service which is now operated

(Concluded on page 200)

AERIAL AGE

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A NEW pursuit plane was tested last month by the Curtiss Company. It is an all metal biplane, duraluminum construction, except for the wings, which are laminated wood and it is the latest type of aircraft designed by the Curtiss Company.

We are glad to see this latest attempt made by an American firm to tackle metallic construction of aircraft which, for some mysterious reason, has been largely so far the specialty of German aircraft manufacturers.

We sincerely hope that every encouragement will be given by the government to the development of metallic construction in this country.

We do not see anything very mysterious about foreign metallic construction that we could not improve upon if the proper amount of money was spent for tools, jigs and fixtures that are 90% of the secret of a good job of this kind.

Of course it would be poor business judgment on the part of any manufacturer to lay in a costly equipment of special tools needed and gamble on the chance of getting an order from the government that would make it worth while investing in the business the money required for producing a good job.

Would it not be a good plan to provide funds for building twenty metallic aircraft frankly designed for commercial purposes and use them in connection with the U. S. Air Mail Service giving the job to the aircraft manufacturers that will submit the best design of a commercial metallic aircraft at a fair price?

If we never make experiment on a sufficiently large scale of metallic construction we will never know if aerial operating companies of to-morrow will have to adopt metallic aircraft or else will have to stick to wood construction.

THE combined experience of the Air Service of the United States and the Allies during the war goes to show that twenty-five years is about the upper limit of age for fliers, although in a number of instances much older men have done excellent service.

The registration in the first draft showed that there were ten and a half million men in the United States in 1917 between the ages of twenty-one and thirty-one, or roughly, one million for each year of age, which would mean four million between the ages of twenty-one and twenty-five.

The same war experience has developed the fact that roughly only one out of every one hundred young men possesses sufficient mental development and satisfactory physique to stand the strain of flying.

The American Society of Mechanical Engineers bases on this ratio its estimate of the apparent maximum number of young men available for service as pilots of commercial passenger-carrying machines which does not exceed 40,000 and assuming that, at best, not more than one-half of the men available for this service would actually go into it, concludes that we can count on about 20,000 pilots only. Taking 20,000 as a fair estimate of the number of pilots on which we can count, and figuring on having 90% of them always on the job and flying all of them four hours per day we can only have 3,000 airplanes in the air at any time of the day and night.

This number is ridiculously low when compared to the number of men and women who are driving an automobile to-day and the number of automobiles which are rolling on the roads of the United States at any time of the day and night. This number, however, cannot be raised unless we design and build aircraft in which the human equation, represented by the pilot, is not such an important factor as is the case to-day.

This goes to show once more that the main problems of aeronautics to-day are technical problems which must be solved by scientists, engineers and manufacturers and that no money should be spared for making possible the solution of these problems right in the field where they belong, which is *the aircraft manufacturing industry*.

THE horrors of air raids in the future are suggested by a recent article in the "Daily Mail" by an armament expert, recently on the Allied Commission in Germany. He says that in the course of his duties in Germany he examined "two instruments" for dealing destruction and death more terrible a thousand times than the most vivid imagination of fiction.

The first discovery was an incendiary bomb weighing less than one pound which forms on exploding an "incandescent mass of white-hot metal that would melt its way through armor plating. A thousand of these bombs could be carried by one airplane.

The second discovery was a "little glass globe containing a dark brown liquid." When the glass is broken, thousands of cubic feet of poison gas is generated. One raid with airplanes using such bombs would paralyze the very heart of the United States and bring horrible death to most of the inhabitants of New York. These are facts and not pipe dreams. However, what are we doing in order to protect ourselves and other nations from the horrors of an aerial war?

THE Aicrraft carrier tonnage allowed by the Washington treaty for the reduction of Naval Armaments has alloted both to the United States and to Great Britain 135,000 tons.

At present Great Britain has 62,500 tons of aircraft carriers of first line and 25,900 tons of the second line. We have no aircraft carrier of first line and only 12,700 tons of aircraft carriers of second line.

These eloquent figures should provide food for thought to our legislators. It is quite true that if we have a well organized aircraft manufacturing industry we do not need to maintain a large military and naval air force in time of peace. But if it is true that aircraft manufacturers can turn out hundreds or even thousands of aircraft per day in time of war, the same is not true of ship builders in so far as aircraft carriers are concerned. We cannot build overnight 109,-000 tons of aircraft carriers that are needed by the Navy and it is not easy for us to see eye to eye with those who are aiming at disarmament and are neglecting the admonition of "Safety First".

THE chauffuer of an automobile who, due to carelessness on his part, causes injury to a passenger driven by him, is subject according to law to prosecution for manslaughter. Why should not the same legislation apply to careless pilots (both military and civilians) who succeed in saving their lives in an accident after destroying valuable property and endangering the lives of passengers?

We think that a good example of this nature would act more efficiently in developing a better judgment in some pilots than the continuous appeals that we are making to their sense of responsibility to themselves and to others.

Commercial flying must be used by conservative people who have too much respect for their own lives and the lives of others to be subject to the lack of judgment of some pilots that has already cost a good many lives which could have been lived for a better purpose.

Wright Patent Expiration and the Manufacturers Association

IN THE March number of AERIAL AGE it was recalled that the Wright patent, around which such a long legal battle was fought, was about to expire.

Lest the article be taken to mean that there are no other patents to be considered, it may be well to add to the previons statement, though one could scarcely interpret the article as referring to any but the one Wright patent of fame.

Some two hundred other patents are as a matter of fact, concerned in the cross-licensing system of the Manufacturers Aircraft Association. One of the considerations of the $200 royalty on each machine manufactured by members, paid in to the association, is the use by members of all development patents of members.

The cross-licensing agreement under which the Wright patent was adjudged of value included at the time of its original making, all the other patents then existing held by manufacturers. The Wright-Martin company was to receive royalties on all airplanes produced by the association members up to $2,000,000 on their then existing patents or until the demise of the patent. The company has received about three-quarters of this sum in royalties. A similar arrangement was made with respect to the larger group of Curtiss patents by which the Curtiss company would receive equal amount of money or until the expiration of one of the controlling patents, in 1933.

The Manufacturers Aircraft Association in which this large number of so-called development patents were pooled was organized as a war measure in 1917, and now consists of 16 makers.

The National Advisory Committee annual report for 1917 says:

"In January, 1917, the War and Navy Departments called the attention of the Advisory Board to the prohibitive prices of aircraft charged by the various aircraft manufacturers, attributing these prices to the extra item of royalty added by each firm in anticipation of infringement suits by owners of alleged basic aeronautic patents who were then threatening all other airplane and seaplane manufacturers with such suits, and causing thereby a general demoralization of the entire industry. After numerous meetings with Government officials, owners of patents, and aircraft manufacturers, extending over a period of several months, the committee recommended the organization of an association among aircraft manufacturers for the purpose of cross-licensing aeronautic patents between the members, such association to be known as the Manufacturers Aircraft Association. The committee cooperated also actively in the determination of the general tterms and conditions of this agreement and in securing its adoption by the leading aircraft manufacturers of the country. The purposes in view of the formation of this association and which it is believed have been achieved, are the following:

1. "The prevention of the virtual deadlock with danger of monopoly existing under the patent situation as obtaining previous to its consumation, and the removal of restraint upon the trade operative under the existence of this patent situation;

2. "The settling or avoiding of all litigation,, actual and prospective, under the previously existing patent situation;

3. "The opening of the industry to free competition of all airplane manufacturers and the opening of all patents held by the membership of the association to equal use and on equal terms.

4. "Provision, as set forth in the articles of agreement, whereby a design originating with a given manufacturer may be put into production and used by another manufacturer with all design data, drawings, specifications, etc., on the payment of a small fee, thus facilitating quantity production of an approved design and stimulating the production of new designs or processes;

5. "The development of financial stability and confidence in the airplane industry, thus making possible the financing of the absolutely needed expansion in order to take care of the expected demands;

6. "Reduced cost of aircraft to the Government by reduction of airplane royalties payable under all patents made available under the association to an amount less than one-half the figures previously demanded under a part only of these patents;

7. "Broadly speaking, the encouragement of airplane production to the highest practicable degree and with reference to the demands of the Government under war conditions."

Howard E. Coffin, Pres. B. H. Mulvihill, V. Pres. B. F. Castle, Treas. John B. Coleman, Rec. Sec.

Official Bulletin of National Aeronautic Association of U. S. A.

Col. H. E. Hartney, General Manager Cable Address, Nataero
National Headquarters, 26 Jackson Place, Washington, D. C.
The National Aeronautic Association of U.S.A. assumes responsibility for the statements under this heading

FOR THE guidance of all those concerned in the organization of local chapters of the National Aeronautic Association and for the information of the members of the Association and the public at large, the following memorandum of chapters together with definitions, applications for charters and by-laws, are printed by arrangement with this magazine.

Memorandum on Chapters.

(A) The advantages of the Chapter are—

(1) It provides a means of social intercourse between the members, and an opportunity for members to broaden their acquaintanceship and their usefulness to their communities through committee work.

(2) It provides a community with a strong unit of a national body which, by its construction, is able to reach every phase of activity in that community on aeronautic matters.

(3) It provides an agency which, in the future, will be able to handle most of the detail of membership renewals and records.

(4) By the fact that the Chapter is a newly-created organization, which is able to cooperate with every pre-existing organization in the community, all danger of arousing dissension and jealousy on the grounds of favoritism, is done away with. The Chapter can only be organized after the membership of the particular community reaches one hundred. This provides a nucleus which can be greatly expanded once a Chapter is formed.

(5) Through the committees of a Chapter, the Association is able to hold out to prospective members interesting, patriotic, broadening and instructive work.

(6) When a member of the Association has a local Chapter available, the Association is able to keep him interested in the work of aeronautics and the Association: and the possibilities for renewals is greatly increased.

(B) Committees:—

National Headquarters has provided that each Chapter will have the committees listed below, and will issue a pamphlet entitled "Instruction for Forming Chapter Committees", and will also furnish bulletins, letters, and general information from time to time entailing suggestions to Chapter Committees, and requiring reports which will keep the committees active.

These committees are:—

(1) Finance and investment.
(2) Airways and landing fields.
(3) Junior activities and education.
(4) Publicity.
(5) Membership.
(6) Entertainment.
(7) Legislation.

(C) Instructions to Committees:—

The instructions on forming committees and suggestions, bulletins and assistance emanating from National Headquarters will be based on the following for each committee:

(1) Finance and investment:

a. Formation of Committee.

This committee should be comprised of leading bankers and investment brokers.

b. Suggestions.

The committee will pass on all questions of finance affecting the Chapter and its work; should cooperate with the Airways and Landing Fields Committee, by providing plans for the financing of any project sponsored or proposed. It should investigate carefully any aeronautic investment proffered the public in the community; prepare budgets for meets, events or entertainments promoted by the Chapter; arrange for the financing of the Chapter.

c. National Headquarters.

National Headquarters will furnish members with articles, pamphlets, suggestions and data on any phase of finance bearing on aeronautics; will keep the committee informed on aeronautic progress and development from an investment point of view. Confidential reports on all responsible and irresponsible companies will be furnished. Cooperative contact will be established by National Headquarters with bankers' associations, the Aeronautical Chamber of Commerce, and the Investment Committee of the U. S. Chamber of Commerce.

(2) Airways and Landing Fields:

a. Formation of Committee.

This committee should comprise real estate dealers, bankers, contractors, civil, electrical, and mechanical engineers, architects and pilots.

b. Suggestions.

This committee should take steps to obtain a civic landing field. Plans should conform to regulations laid down by the Airways Section, Air Service, U. S. A., and those provided by the Safety Code Committee, Bureau of Standards. Contact should be established with the nearest cities, in order to promote a series of landing fields, which could be utilized as an airway.

c. National Headquarters.

National Headquarters will furnish this committee with War Department documents, maps, copies of proposed Safety Code, and special bulletins. It will establish co-operative contact with organizations working on allied subjects. Price lists of supply houses, estimates and blueprints of equipment, and all other material to be used, will be provided.

(3) Junior Activities and Education:

a. Formation of Committee.

This committee should have as members the president of the School board; members of the leading private institutions; the president and some professors of the local college or university, if any; a few select teachers, and the pastors of those churches most active in child welfare.

b. Suggestions.

This committee should arrange for a course of talks on aeronautics in the different schools; cooperation with the local boy scout masters; prize essays; newspaper essay contests; and carry on any other work which will not only stimulate the interest of the youth in aeronautics, but instil a proper patriotism and appreciation of the importance of preparedness.

c. National Headquarters.

Pamphlets, bulletins, and detailed suggestions will be furnished the committee by National Headquarters. National Headquarters will arrange co-operative affiliations with the boy scouts, educational societies, and Government and State organizations.

(4) Publicity Committee:

a. Formation of Committee.

This committee should have as members the editors of the leading local papers, magazines and journals; local literary celebrities, writers and theater owners.

b. Suggestions.

This committee will arrange for the proper treatment of aeronautics by newspapers; assist Junior Activities and Education Committee in arranging essay contests; obtain items of news value, and cooperate through the committee department of National Headquarters, with the Director of Information.

c. National Headquarters.

National Headquarters will prepare local publicity features for release; information bulletins; pamphlets of instruction and suggestions for this Committee.

(5) Membership:

a. Formation of Committee.

This committee should be comprised of the members of the Chapter who are active in social, civic and society organization work.

b. Suggestions.

This committee should arrange through the Advisory Committee special membership drives to be carried on in all organizations in the community; should work in close harmony with the Junior Activity and Entertainment Committees, and endeavor to keep a large average of memberships coming in. It should see that each representative of any organization serving on the Advisory Committee becomes a member. It should prepare and keep records of prospects, and plans for future campaigns.

c. National Headquarters.

Bulletins and suggestions, as well as active cooperative assistance on the part of paid executives of both National and District Headquarters, will be forthcoming.

(6) Entertainment Committee:

a. Formation of Committee.

This committee should comprise members prominent socially, persons active in theatrical work, fliers, and others prominent in the community.

b. Suggestions.

It will arrange for luncheons, balls, dinners, lectures, meets and other special events, and endeavor to provide social entertainment for the Chapter.

c. National Headquarters.

Speakers, cooperation of the National Contest Committee, bulletins, pamphlets and suggestions, will be furnished by National Headquarters.

(7) Legislation:

a. Formation of Committee.

This committee should comprise the leading lawyers, and those in the forefront of political activity of the State, residing in the particular community.

b. Suggestions.

This committee should keep in touch with all Federal legislation and all legal phases of aeronautics.

c. National Headquarters.

Information bulletins and pamphlets, and other suggestions, will be furnished from time to time by National Headquarters.

(D) Advisory Committee:—

Under Article VII, Sections 1 and 2 of the Chapter Constitution and By-Laws, all local organizations may have from one to five representatives to attend all open meetings of the Chapter, and serve with the Board of Directors on an Advisory Committee.

a. Formation of Committee.

This committee should be composed of as many of the five representatives as possible of such organizations as the local Kiwanis Club, Lions Club, Rotary Club, Chamber of Commerce, local Aero Club, Air Board, Merchants' Association, Manufacturers' Association, Board of Trade, Women's organizations, etc.

b. Suggestions.

This committee should devise plans for joint lectures, circularizing the respective membership of each organization for membership in the National Aeronautic Association; promulgation of aeronautic information; obtaining the interest of, and active work for all aeronautic civic development of each organization.

c. National Headquarters.

National Headquarters will furnish pamphlets, suggestions and data to this committee from time to time, as well as lend assistance, such as speakers, organizers, etc.

(E) Women's Advisory Committee:—

When sufficient women become members of the National Aeronautic Association from any Chapter community, they should immediately be formed into a women's Auxiliary Committee.

a. Formation of Committee.

This committee should comprise those women members of the Chapter who are active in social, civic, educational and political work.

b. Suggestions.

This committee should establish active cooperation with all local women's organizations, such as the Red Cross Chapter, League of American Pen Women, Women's Clubs, Daughters of the Confederacy, Daughters of the American Revolution, League of American Women Voters, etc. The committee should carry on any activity which it deems necessary, not only for the advancement of aeronautics, but to further any civic cause of general benefit to the community.

c. National Headquarters.

National Headquarters will furnish the committee suggestions, contracts, data and information which it is deemed will assist.

ANY ten members of the National Aeronautic Association of U. S. A. residing in the same community may make application for authority to form a Chapter. Upon receipt of such application, approved by the Governors of the District in which the community is situated, the applicant members will be granted a Charter by the National Body authorizing the creation of a Chapter under terms and conditions which will be uniform throughout the nine Districts of the Association: Provided, however, that no application for the Charter of a Chapter will be approved unless at least one hundred members, in good standing, reside in such community.

A Chapter is designed to bring into an organized unit in a community the members of the association in order to promote social intercourse; to concentrate the efforts of the members in the furtherance of Aeronautics in the community; to add strength to the National Body by providing an organized sub-division in each locality, and to carry out such local aeronautic events as are approved and which will have the co-operation of the National Aeronautic Association.

APPLICATION FOR A CHARTER

AUTHORIZING THE FORMATION OF A CHAPTER OF THE

NATIONAL AERONAUTIC ASSOCIATION OF U. S. A.

IN

Whereas we, the undersigned, are members in good standing of the NATIONAL AERONAUTIC ASSOCIATION of U. S. A. residing in.........................
And

Whereas the members in good standing of the NATIONAL AERONAUTIC ASSOCIATION of U. S. A. residing in.... ....,total ....; And

Whereas we realize the importance and advantage of forming ourselves into a Chapter in order more effectively to further the work of the Association; And

Whereas we are familiar with the necessity of applicants conforming to the rules and regulations governing the formation of such Chapters; And

Whereas we agree to arrange for the election of the proper officers and committees; And

Whereas we are familiar with, and agree to adopt, the provisions of the Constitution and By-Laws for a Chapter;

Now, therefore, We request a Charter from the NATIONAL AERONAUTIC ASSOCIATION of U. S. A. granting us authority to create a Chapter in the City of ....
State of ....
Approved:

....
Governor.

....
Governor.

Signed

....
....
....
....
....
....
....
....

By-Laws

of the ——————————Chapter
National Aeronautic Association
of U. S. A.

ARTICLE I

Name

SECTION 1. The name of this Chapter shall be the ....
Chapter, National Aeronautic Association of U. S. A.

ARTICLE II

Objects

SECTION 1. The objects of this Chapter are:

(a) To bring into closer relationship all members of the National Aeronautic Association residing in, or near, the City of ....,State of ....

(b) To create an organization in the City of............,State of..........., which will more effectively carry out the policies of the National Aeronautic Association.

(c) To more effectively stimulate interest in, and disseminate information of, aeronautics in the City of..............., State of.............................

(d) To provide an organization which, because of its greater local strength and its connection with the National Association, will be able to keep the City of..... ...., State of ...., abreast of aeronautic figures.

(e) To create an organization which will lead the City of.................... State of ...., in all aeronautic matters..

(f) To provide an organization which is able to analyze and report upon all aeronautic undertakings which may be offered to the citizens of the City of...... ....,State of ....

ARTICLE III

Membership of Chapter

SECTION 1. All members of the National Aeronautic Association of U. S. A. residing in, or registered on the rolls of the National Organization as of, the City of.............., State of.............., are perforce members of this Chapter.

SEC. 2. Any member upon change of residence will be transferred to the roster of the District of his new residence and assigned to the Chapter nearest thereto, upon application of the said member to National Headquarters; provided, however, a Chapter exists within the new state of residence and within one hundred miles of such residence.

SEC. 3. All fees, dues, quotas and allowances as are now provided, or may be provided in the future, in favor of the Chapter from which a member is transferred, shall terminate in respect to said Chapter as of date of said member's transference, and thenceforth shall be granted the Chapter to which such member is assigned; provided, however, that membership fee quotas, once paid a Chapter, will not be transferred to any other Chapter.

ARTICLE IV

Directors, Meetings and Elections

SECTION 1. The Business and Property of this Chapter shall be managed by a Board of Directors, consisting of not less than five nor more than nine members, elected as provided in Article IV, Sec. 2 below. The Directors shall also be responsible to the National Association that the Chapter follow all policies and regulations of the District Headquarters and National Headquarters.

SEC. 2. Those members who sign the roster, attached hereto, and who are in good standing, shall be entitled to vote at all elections and on all matters brought before any meeting of the Chapter.

SEC. 3. A meeting of all the members of the National Aeronautic Association of U. S. A. residing in, or near, the City of ....,State of................, will be called immediately upon receipt of the Charter, such meeting to be held within fifteen days thereafter. At this meeting these Articles are to be adopted, and the Board of Directors and such officers as are provided for in Article V, Sec. 1 below are to be elected.

SEC. 4. The regular annual meeting of the members of the Chapter shall be called each year within thirty days after the General Convention of the National Association to act upon the policies adopted by said General Convention, and to elect the Directors and Officers of said Chapter for the ensuing year. Other meetings of the Chapter may be called from time to time at the discretion of the Directors.

SEC. 5. A majority of the Directors shall constitute a quorum, and a vote of a majority of a quorum shall determine all matters before any Directors Meeting. The Directors shall meet at least six times a year and special meetings may be called by the President or by any two members of the Board at their discretion.

SEC. 6. Each Chapter shall appoint and send three delegates for the first one hundred of its membership, and one delegate for each additional one hundred membership or fraction thereof, to the District Convention, as provided in the Constitution and By-Laws of the National Association.

ARTICLE V

Officers

SECTION 1. The Officers of this Chapter to be elected by the members of the Chapter shall be a President, a Vice-President, a Secretary, and a Treasurer, who shall, by virtue of election to these offices become members of the Board of Directors. If the growth of the Chapter warrants the appointment of an Executive Secretary to conduct the routine business of the Chapter the Directors may appoint such an officer and delegate to him such powers as the Board sees fit.

President

SEC. 2. The President of the Chapter shall preside at all meetings of the Chapter and of the Board of Directors, shall be ex-officio member of all committees, and shall see that the secretary calls all meetings as herein required or as determined upon by the Directors. He shall see that all reports and records required by the Directors, the District Headquarters and National Headquarters; are kept by the person designated. He shall also see that all of the policies and regulations of the District Headquarters and National Headquarters are complied with.

Vice-President

SEC. 3. The Vice-President shall perform all the duties of the President during his absence.

Secretary

SEC. 4. The Secretary shall keep such records, call such meetings, and make such reports as are herein provided for or as may be required by the Directors, District Headquarters and National Headquarters.

Treasurer

SEC. 5 The Treasurer shall keep such funds and records in such manner as shall be provided by the Directors, provided, however, that the depository shall be named by the Directors and the disbursements from any bank account be by checks signed by the Treasurer and countersigned by one other officer to whom this duty is delegated by the Board of Directors.

ARTICLE VI

Committees

SECTION 7. The Directors must name the following Committees and see that they are supplied with the necessary instructions and bulletins furnished by District or National Headquarters:

(a) Finance and Investment.
(b) Airways and Landing Fields.
(c) Entertainment.
(d) Junior Activities and Education
(e) Legislation.
(f) Publicity.
(g) Membership.

SEC. 2. Such other Committees as are found necessary because of local conditions may be appointed.

ARTICLE VII

SECTION 1. Any distinctly local organization, or local branch of a State or National, Business, Civic, Patriotic, Charity or Social organization may delegate from one to five of its members, in good standing, residing in, or near, the City of ...., State of ...., to attend all open Meetings of the Chapter as representatives of such organization. Nothing in this or the following Section is to be construed to preclude either a Member of the Chapter serving as such Representative or such Representative becoming a Member of the Chapter by joining the National Association.

SEC. 2. An Advisory Committee shall be formed consisting of these Representatives and of the Board of Directors of the Chapter. The purpose of this Committee is to bring about greater harmony, cooperation and effectiveness in the work of the Chapter on all matters pertaining to the general aeronautic welfare of the City of ...., State of..............

ARTICLE VIII

SECTION 1. These Articles may be changed by a majority vote of the members of the Chapter, provided, however, that proposal for such change be first submitted by the Directors to, and consent obtained from, the Governors of the District and the President of the National Association.

GUIDE BOOK OF AIR LINES IN THE UNITED STATES.

In co-operation with the National Aeronautic Association, the United States Touring Information Bureau, for the first time in the history of this country, includes in its directory a map of air lines in the United States, together with the location of more than 3,000 landing fields, improved and unimproved, which stretch from the Canadian border to the Mexican boundary. Together with the map is included a compilation of the various facilities offered at landing fields for the use of itinerant flying, for regular air lines, and for Government use, either for the Air Mail or in connection with the Army and Navy services.

This data was secured in co-operation with the National Aeronautic Association of the United States, in conjunction with the Army Air Service, the Airways Section of that service contributing the records of its well-organized airways section.

The Bureau and the Association realizing that two of the factors which are retarding the development of commercial aviation on a grand scale in this country are the lack of adequate landing fields and the lack of suitable gasoline supply stations, have united in an effort to spread the information regarding the facilities which are available, with the hope that our citizens will respond to the need of establishing more landing fields and gasoline stations which will not only contribute to their own economic advantage, but will fulfill in a large measure the purposes of both the Bureau and the Association.

Aviation, now having become a commonplace activity throughout the country, it was felt that to supplement the touring information service and camp ground directory with information covering the landing fields of the United States and their facilities, together with route maps, would be invaluable to the touring public. Therefore, there has been installed in the office of the United States Touring Information Bureau at Waterloo, Iowa, a service for aviation comparable to that rendered to automobile tourists. This is a unique feature which is not available elsewhere in this or any other country, and the Bureau believes that it is making history in this new departure in its service.

Aviation naturally depends upon the automotive industry for its advancement along technical lines. Therefore, it is closely allied with the automobile industry, the two going forward hand-in-hand in the development of our transportation facilities in connection with the ever increasing demand for speed and promptitude in commercial transactions. In consequence of this allied interest, the U. S. Touring Information Bureau will be from now on, able to furnish to its patrons accurate information regarding landing fields now installed, airways now in operation, and those which will be developed from time to time. Frequent additions to this guide will be most lavish in the direction of completeness, and patrons of the Bureau and members of the Association will have the most up-to-date facilities at their disposal. This guide is furnished free to members of the N. A. A. together with the new Service Bureau Information.

The Headquarters of the National Aeronautic Association are located at Washington, D. C. but it has nine districts with headquarters comparable to the nine Corps Areas of the Army, thus linking into the chain of national defense established by the Government. The districts are divided into numerous chapters throughout the country, thereby comprising one of the most comprehensive and constructive movements ever undertaken in any phase of transportation development.

At the headquarters of the United States Touring Information Bureau, at Waterloo, Iowa, information is on file covering the locations of the District Headquarters and the various chapters of the National Aeronautic Association throughout the United States. Persons desiring information in regard to these matters may write into the Bureau Headquarters and such information will be freely and gladly given.

The members of the N. A. A. are invited the use of this service. It is complete, and of great economic value. Tours will be laid out upon request making use of all available transportation facilities furnished by the aeronautical industry at the present time, and as such are put into operation and made available.

THE NEWS of THE MONTH

Wright Aeronautical to Build Planes

The following announcement was made by F. B. Rentschler, president of the Wright Aeronautical Corporation:

"After careful consideration, our company is now providing facilities for carrying on the experimental development of plane types. It is believed that active development of complete units for aircraft will ultimately make for the best product.

"Sometime in March we expect to have ready for occupation a new plant, constructed alongside our present one, which will house our plane activities. This plant will be just as modern in every detail as our present one, and will be sufficient to carry out our present program.

"It is expected that by spring we shall have concluded negotiations for flying facilities at some place adjacent and convenient to Paterson.

"Because of the intense concentration necessary during the war, it seemed advisable for our company to devote its entire activities to the development and manufacture of aeronautical engines. It was, therefore, quite natural that at the end of the war period we should continue to engage principally in the manufacture and development of engines. It is, of course, entirely consistent that the organization bearing the name of Wright should eventually resume the development and manufacture of complete airplanes."

Plan Flying Tournament For Sesqui-Centennial.

Plans for an internation flying tournament to be held by the Aero Club of Pennsylvania during the proposed Sesqui-Centennial exhibition in 1926 were considered at the meeting of the club at the Engineers Club last night. It was also announced that a semi-weekly dispatch edited by the club would be broadcast from one of the local stations within a few days. An illustrated talk was given by W. N. Jennings on aerial photography. President W. Wallace Kellet appointed the following committee on the proposed tournament: Hollinshead N. Taylor, B. C. Dallin, C. T. Leudington and Roy G. Miller.

New Plans of Curtiss Co.

The majority stockholders of the Curtiss Aeroplane and Motor Company, through C. M. Keys, the largest stockholder in the corporation, on March 13 announced that a plan calling for the rorganization of the company's financial structure has been worked out and was being presented to all stockholders for their approval. The plan, according to Mr. Keys, calls for no new financing and results in the decrease of the present outstanding capitalization.

The plan calls for the creation of two new companies out of the present organization, one of which will be a purely manufacturing company. The other will be engaged in liquidating assets. The manufacturing company will probably be known as the Curtiss Aeroplane and Motor Company and the other the Curtiss Assets Company.

The statement issued by Mr. Keys, in part follows:

"The Curtiss Assets Company will buy commercial aeroplanes and motors and spare parts, worth approximately $1,600,000, and also all the American aeroplane patents from which royalties are now received. The Assets Company will issue $2,731,500 certificates of beneficial interest. which will ultimately become the property of the present preferred stockholders. As assets are liquidated, either by sale or receipt of royalties, the funds will be distributed directly to the preferred stockholders. A contract will be made between the two new companies under which the manufacturing company will meet all of the expenses of the Assets Company, just as the present corporation

The Navy-Wright plane, equipped with Wright T-2, 12 cylinder engine. The first complete airplane of the Wright Aeronautical Corporation

meets all of the expenses at the present time."

Operating Results of Curtiss Co.

The following statement was supplied to the press on February 22 by C. M. Keys, President of the Curtiss Aeroplane and Motor Corporation:

To the Stockholders, Curtiss Aeroplane & Motor Corporation: The operating results of your company for the year 1922, subject to audit by Price, Waterhouse & Co., and therefore, subject to minor change, showed a profit of $16,169.94, compared with the profit of $101,207.17, for 1921.

Orders on the books at the close of the year amounted to $3,752,009.02, as compared with $1,763,224.55, in 1921.

The policy of concentrating the efforts of the corporation on engineering, which was inaugurated when the present management took control of the corporation in 1920, culminated during the year in the establishment of a new method of cooling motors and in the winning of the Pulitzer Race, in which Curtiss ships finished first, second, third, and fourth, all four making world's records for a closed course.

This success is directly responsible for the re-entrance of the corporation into motor building on a substantial scale. This, in turn, has resulted in the re-opening of a part of the Buffalo factory so that this unit, instead of being a burden on the company's finances, should be in 1923, the most profitable part of the company's plant.

The policies of the company will remain unchanged throughout 1923. It is necessary to revise the capitalization of the company and a plan to this effect will be submitted to the stockholders shortly for their approval. It may also be necessary, in view of the larger volume of business being transacted, to arrange for the raising of working capital. The possible need for this is reflected in a decrease of cash on hand at the close of the year from $994,880.52 in 1921, to $174,744.12 in 1922, and an increase of the Government work in production from $122,629.81 in 1921, to $791,978.62 in 1922.

At the Annual Meeting of the Curtiss Aeroplane & Motor Corporation, retiring directors were reelected, and Arthur H. Marks, New York, President of Skinner Organ Co., and former President of Diamond Rubber Co., was elected a director to fill a vacancy.

New Aeromarine Enterprise

A network of aerial commercial transportation routes following the waterways and coast lines of the United States will be put into operation as soon as the personnel and equipment can be developed, Charles F. Redden, President of Aeromarine Airways, Times Building, has announced. In connection with the program of expansion, Mr. Redden said that an Aeromarine Advisory Board, consisting of thirty-five industrial, banking and aeronautical men, had been formed to arouse the country to the necessity of developing support of commercial aircraft.

The Aeromarine plans to inaugurate flying boat service between New York and Miami (daily service beginning next Fall); New York and Chicago via Montreal, Buffalo, Cleveland and Detroit with stops at these cities; Galveston and Tampico, New Orleans and Havana, New York and Newport, R. I.; Los Angeles and Catalina Island and Vancouver, B. C., and Seattle.

The Aeromarine Company, which is said to be the largest operator of flying boats in the world, at present maintains routes from Miami to Nassau and Bimini, and Key West to Havana, in addition to a sightseeing service around Manhattan. Last Summer the company operated a route between Cleveland and Detroit and from this city to Atlantic City and Newport.

Among the members of the Aeromarine Advisory Board announced by Mr. Redden are: Rear Admiral W. F. Fullam, U. S. N.; Colonel Sidney D. Waldon, formerly President of the Detroit Aviation Society and a leader in aeronautical development; Colonel J. G. Vincent, Vice President of the Packard Motor Car Company and designer of the Liberty motor; Colonel H. H. Emmons, President of the Detroit Board of Commerce, Allan Jackson, Fifth Vice President of the Standard Oil Company of Indiana; John D. Larkin Jr., Vice President Larkin Soap Company; R. C. Hyatt, Vice President Union Trust Company, Cleveland; W. E. Scripps, Vice President of The Detroit News; E. C. Romfh, President The First National Bank, Miami; E. G. Sewell, President Miami Chamber of Commerce; Professor Edward P. Warner, Massachusetts Institute of Technology; C. J. Tilden, Chairman, Division of Engineering, Yale University; C. F. Marvin, Chief of Weather Bureau; Gordon Lee, formerly Chief of the Automotive Division, Department of Commerce; Colonel H. W. Alden, Chairman of the board, Timken-Detroit Axle Company, and General Alberto Herrera, Chief of Staff of the Cuban army.

Commenting on the project, Mr. Redden said:

"Believing that aeronautical development has now reached a point where it is entitled to public support on a substantial scale, when conducted under proper auspices, we have asked this committee to cooperate with us in our efforts to put the cause of commercial aviation on a permanent basis. In the course of our operations we have built up a fleet of air cruisers and developed a flying organization which has established a record of performance that has never been equalled heretofore except possibly by the United States Air Mail Service. With more than 1,000,000 passenger miles flown and 20,000 passengers carried, we have demonstrated conclusively that flying is safe, and, further, that, given a safe and efficient flying service, the public will take advantage of this newer and speedier means of transportation.

Some of the planes of the Johnson Airplane Co. at Johnson Field, Dayton, Ohio

"During the coming twelve months it is our intention to add extensively to the Aeromarine Airways service by opening up new routes and increasing the facilities of present lines, and it is in preparation for this step that we have obtained the co-operation of this committee. Being firm believers in the future of air transportation, as these prominent men are without exception, we are satisfied that their co-operation will be an assurance to the public that this great young industry has now established itself on a sound and permanent basis."

The officers of the Aeromarine Airways, Inc., are: President, Charles F. Redden; Vice President, John W. German; Development Director, H. F. Bruno, and Chairman of the board, Inglis M. Uppercu.

Important Notice to Air Pilots

All airplane, balloon and dirigible pilots, who have secured their Federation Aeronautique Internationale brevets, are requested to send their brevets to the Contest Committee of the National Aeronautic Association of the U. S. A., 26 Jackson Place, Washington, D. C., with a request for yearly aerial license, which is issued without charge. The brevet will be returned, together with the license.

It is necessary for all pilots entering aviation meets or other aerial events to present the annual license in connection with the brevets, which will indicate that they are pilots in good standing, that they are constantly engaged in flying and, therefore, qualified to enter into aeronautic competitions.

The Boston Airport

The new Boston Airport is located on land recently filled by the Commonwealth of Massachusetts between Jeffries Point, in East Boston, and Governors Island. It lies approximately one mile east of the State House dome.

The field for the present will consist of two runways in the form of a T 1,500 feet long. Cross bar of T runs northeast-southwest, base northwest-southeast. The runways are covered with cinders for a width of 100 feet and graded for 50 feet on each side of that. Four hangars are being erected southwest of the runways.

Landings should be made on the runways, as the remainder of the field is impractical for landing at present. The runways can be seen easily, as the cinders contrast sharply with the surrounding light-colored clay.

The field will be ready early in the spring of 1923.

Further information may be obtained from the Boston Chamber of Commerce or from the Air Officer, First Corps Area, Army Base, Boston.

Schneider Cup Race

The Navy Department has informed by cable March 8 that the European speed classic for Jacques Schneider aviation marine trophy will be held off Cowes, Isle of Wight, England, on Sept. 28. The entrants will have a contest for navigability on Sept. 27.

The National Aeronautic Association on behalf of the Bureau of Aeronautics of the Navy has entered three seaplanes in this international competition. It is the first time the United States has entered the contest for the trophy worth 25,000 francs offered by the Aero Club of France. The competition is under the direction of the Federation Aeronautique Internationale, which is represented in America by the National Aeronautic Association, with headquarters at Washington.

Entries have already been made by aero clubs of Great Britain, France and Belgium.

Free Balloon Contest

Commercial organizations and aero clubs of Detroit, Indianapolis, Milwaukee and San Antonio have all filed claims to the free balloon competition scheduled for early June with the contest committee of the National Aeronautic Association. According to B. Russell Shaw, chairman of the committee, there never has been such intense rivalry for this elimination event so early in the year, nor so strong backing by four large cities of their local claims. Milwaukee, where thirteen contenders started in last year's race that was won by Major Oscar Westover of the Army Air Service after a sensational flight, is doing its utmost to cinch this year's event. The aero club of Indianapolis has started an active campaign, and in Detroit and San Antonio enthusiasm is running high

Three mystery entries for the contest are causing balloon sharps to speculate on identity of the probable pilots; two new balloons will be entered by the Aircraft Development Corp. of Detroit, and St. Louis will enter a new pilot.

The preliminary list assures the appearance of Ralph H. Upson, of Detroit, winner of the James Gordon Bennett trophy in 1913; Capt. H. E. Honeywell, of St. Louis, who was second in last year's race and protested the award of the trophy to a Belgian balloon; Capt. G. L. Brumbaugh, of Indianapolis; Major Oscar Westover, U. S. Army Air Service; Lieut. Comdr. J. P. Norfleet, U. S. Navy; Capt. John Barry, of St. Louis, the first man to make a parachute leap from an airplane; Roy Donaldson, of Springfield, Ill., Ward T. Van Orman, of Akron, O., and J. S. McKibben, of St. Louis, all contenders in former races.

There will be a purse of $3,000 for the prize winners, from whom will be selected three contestants and three alternates for entry in the International balloon race for the James Gordon Bennett trophy to be held in Belgium, Sept. 23. The American record for free balloon flight has stood since 1910 when Allan Hawley of New York City covered 1,172 miles. The world's mark, made by Berliner of Germany in 1914 is 1,897 miles.

A Deserved Compliment

Richard R. Blythe, chairman of the Aircraft Executive Association has received the following letter from President Warren G. Harding:

"It is a pleasure to make acknowledgment of the fine contribution which the Aeronautic Executives Assn. has made in behalf of aeronautics in this country. It is, I must confess, a little hard for me to believe that there should still be at this late date occasion for special efforts at arousing and maintaining public interest in this new mode of transportation and of national defense. To me, the suggestion of making a special effort to sustain interest in aeronautics seems a good deal like going back eight or nine decades and defending the introduction of the steam railroad. It seems just as apparent that the navigation of the air is bound to be one of the most important modes of transportation, as it is that the navigation of the iron highways has already become such a facility. Rapid, sure and economical transportation comes very near to being the very corner stone of our modern civilization. Certainly we cannot doubt that the highroads of the air are destined to be among the most used and useful means of transportation. Every contribution to the development of this new art must, therefore, be a contribution to the growth of better civilization."

ARMY and NAVY AERONAUTICS

$25,000,000 Annually Suggested for Army Aeronautics

In his final report as Assistant Secretary of War, made public March 12, J. Mayhew Wainwright, who resigned on account of his election to Congress, advocated the adoption of a program calling for an annual expenditure of $15,000,000 in the next five years for the development and expansion of the Army Air Service, besides $10,000,000 annually for operating the service. Industrial mobilization in time of war was also dwelt upon by Mr. Wainwright, who said that the plans of the War Department in that respect were far advanced. "Our most notable deficiency at the present time," Mr. Wainwright said, "is in the matter of aircraft. The situation in the Army Air Service is most critical. Up to the present time this service has been using very largely equipment produced during the war. This supply is practically exhausted. What there is left of it is disappearing rapidly, due to deterioration and to the inevitable losses while in actual use.

"The amounts appropriated for the purchase of new air craft are insufficient to provide what is necessary even for the normal peace time equipment of the present small air service organizations.

"The aeronautical industry in the United States, built up to large proportions during the war, is now practically facing extinction. Until commercial aerial transportation becomes a fact the only demand for such equipment originates with the military branches of the Government. Unless the Government places with aircraft manufacturers sufficient orders to enable them to continue in operation the industry as such will disappear.

"The Army Air Service is faced with this condition of affairs: Its wartime manufactured equipment has been practically used up. The amounts of money appropriated for the purchase of new aircraft are so small that within two years it will have on hand less than one-half the number of aircraft necessary for normal peace time work.

"There will be no aircraft to equip and expand the air service in time of emergency, no reserve on hand, and it will be impossible in less than a year to expand the remnant of the aircraft industry which may be left or to create it anew so that this material can be manufactured in sufficient quantity for use in such an emergency. This situation not only is serious, but actually is alarming.

"The Army Air Service should be large enough and adequately equipped so that it would be prepared instantly to meet any air force which an enemy might bring against us. The importance of the role which the air service will play in the defense of the nation should be thoroughly understood, and this component of the army should be increased to its proper strength. The air service then should have a definite procurement program which would insure proper equipment, replacements and a reserve supply of aircraft for use in an emergency and until war-time requirements could be met by increased production. Such a program would call for an annual expenditure of approximately $15,000,000 per year for the next five years. Thereafter this annual expenditure no doubt could be decreased.

"In addition to this expenditure for new aircraft there would be required approximately $10,000,000 for operating the service.

Regarding industrial mobilization, Assistant Secretary Wainwright said in part:

"The problem is to insure, so far as foresight may provide, that our industrial establishments and factories may be prepared upon the outbreak of war to turn as rapidly as possible, from their peace time tasks to the production and operation of those things that shall have the primary call and preference upon their facilities for production. This call and the load so placed should be, however, so nicely adjusted that the essential needs of the people should be disturbed only so far as is necessary.

"But with munitions and aircraft and related supplies it is another matter. Here as well as elsewhere complex problems arise. The effort must be made to secure an acceleration of production to the utmost extent conformable with the size and rate of mobilization of man power."

Army May Get Z R-3

It is quite within the bounds of probabilities that the Army Air Service may be the recipient of the ZR-3, the reparations airship now approaching completion in the Zeppelin works.

The Navy will have its own airship, the ZR-1, expected to be completed in June, designed and built by Navy engineers. It will be stationed in the monster shed at Lakehurst, N. J.

The Army has the only other shed large enough to house either of these ships, at Belleville, Ill.

In the Summer of 1919 the Army initiated the first negotiations for a rigid German airship. In January, 1920, the Joint Army and Navy Board allocated the development of rigid airships to the Navy. Under the Treaty of Versailles the Navy was named as the procuring agency for the ZR-3, as the Navy has designated the craft.

However, the operation of an airship is not necessarily *development.* The Army has needs for a rigid ship apart from those of the Navy. The Army wants a rigid ship as means of transportation of personnel and supplies between stations and this country and, perhaps, between stations in this country and in its possessions. The Army Air Service wants to weigh by test the possibilities of the airship as an airplane carrier, taking off, landing, servicing and repairing on the airship. The airship is a long distance bombing and reconnaissance instrument with capabilities entirely different in extent from those of the airplane.

The Navy is charged with seaward reconnaissance. Were any combination of powers to attack from the Atlantic, it is possible the naval airships would be drawn to the Caribbean for the defense of the Panama Canal. The Army, had it no airships, would be helpless in aerostation.

The Army has other problems, peculiarly its own, in which the rigid airship figures. One can conceive that the Army has, perhaps, more uses for the rigid ship than has the Navy.

At any rate, without the weighing of respective claims that might be put forward in the event of rivalry in final acquirement, the rigid airship has its place in military aeronautics as in naval aeronautics and without a ship the Army can scarcely study its application to Army aeronautics.

As the ZR-3 is being built on commercial lines, there is the third possibility that, in the event a bureau of civil aeronautics is established, it may be operated by the bureau or by a civil agency under a special arrangement. Then there is the Post Office Department which may be a bigger contender, using the airship in transcontinental mail service.

New Airship Makes Successful Test Flights.

The new Army Airship D-2, recently erected at Scott Field, Ill., by the members of the Airship Class of the Air Service Balloon and Airship School, made its first test flight on Tuesday, February 6th. The test was successful in every way.

The ship was taken out of the hangar at 2 o'clock Tuesday afternoon, and was put into the air immediately. Flying at an altitude of 1,000 feet, the big ship circled the landing field and headed for Belleville, a nearby city. At this time communications were established between the ship and Scott Field by radio telephone, and conditions of the flight were sent down to Colonel C. G. Hall, Commanding Officer.

After the D-2 had been in the air a short time, the operator picked up K. S. D., the broadcasting station of the St. Louis "Post-Dispatch", and as each member of the crew had on a headset, everyone on board enjoyed the concert which was being broadcasted at that time. The ship returned to the field and was landed at 3:04 p. m., after being in the air one hour and four minutes.

The pilots of the D-2 on this flight were Lieut. H. H. Holland, in command; Lt. Arthur Thomas, direction, and Lt. Don L. Hutchins, altitude.

The second test flight of the D-2 was made on Feb. 8th, when, taking off the field at 9:55 a. m., the ship flew over Belleville, crossed the Mississippi, and circled back and forth over St. Louis, Mo. While over the city the ship's commander conversed with the operators of the broadcasting stations of the St. Louis newspapers over the radio. Reports from amateurs who listened in on the conversation are still coming in at Scott Field.

The airship returned to the field after a very satisfactory flight, and was put away in the hangar at 1:20 p. m. On this flight were Lieut. H. H. Holland, in command, Lieut. Arthur Thomas, direction pilot; and Lieut. Ira F. Koenig, altitude pilot.

The D-2 has a capacity of 190,000 cubic feet, is 198 feet long, 51 feet high, and 38 feet wide. It has a full cruising speed of 58 miles an hour and uses two Wright "V" type motors, developing 180 h. p. each. This ship has a useful lift of 4,140 pounds and can take up twelve persons under normal conditions.

It is expected that the D-2 will shortly be turned over to the Air Service Balloon and Airship School for use in instructing students in airship piloting.

West Pointers to Receive Training at Mitchel Field

Mitchel Field, L. I., New York, will have the honor of entertaining the 1924 Class of the United States Military Academy, when approximately 210 cadets are expected to arrive on June 13th. These cadets will remain for a period of two weeks, when they will be replaced by the balance of the class, consisting of about the same number. During the month to be devoted to this purpose about 420 cadets will have visited the station.

A syllabus of instruction is now being worked out to cover the visit of both groups. It is intended giving as an extensive and intensive course of instruction in the rudiments of aviation and the theory of flight as the limited time will permit.

It is realized that this Cadet class will have completed a year of intensive training, and therefore every effort will be made to make their visit pleasant and attractive in addition to being instructive. Numerous social functions are being planned, and arrangements are also being made for the comfort of the cadets' guests. Mitchel Field hopes to make their visit an event that they will long remember with pleasure.

Pursuit Airplane now Equipped for Long Flights.

An MB3A airplane at Selfridge Field, Mt. Clemens, Mich., has been equipped with a releasable gas tank containing 37 gallons of gasoline. This tank is suspended from the bomb rack under the fuselage. The releasing device is controlled from the cockpit. This added supply of gasoline will increase the flying radius of an MB3A to about 400 miles. The tank was designed by McCook Field.

General Mitchell Pilots A Flying Arsenal.

During his inspection of Kelly Field, San Antonio, Texas, General William Mitchell, with his aide, Lieut. Clayton Bissell as observer, piloted a plane from the Eighth Attack Squadron equipped with eight machine guns, demonstrating the practicability of operating this number of guns on one ship. A number of the attack squadrons at Kelly Field have been supplied with DH4B airplanes equipped with eight machine guns each, also with bomb racks.

Night Flying At Scott Field.

Some thirty large flood lights have been installed on the sides of the hangars bordering on the west edge of the landing field at Scott Field, Belleville, Ill. This was done in anticipation of the night flying in airships, which is scheduled to begin in a short time as part of the course of instruction in airship piloting.

Major Hickam's New Assignment

Major Horace M. Hickam, Air Service, who has been on duty in Washington, D. C., as Chief of the Information Division, Office Chief of Air Service, for nearly four years, has been transferred to Kelly Field, San Antonio, Texas, where he has assumed command of the Tenth School Group. He is also Assistant Commandant of the Air Service Advanced Flying School at that field.

It is doubtful if the transfer of an officer from this city to another station has occasioned such universal regret as in the case of Major Hickam. Always cordial and genial in disposition, his host of friends in Washington will surely miss him. We join them in wishing him every success in his new duties.

Major Hickam has been succeeded as Chief of the Information Division by Major Ira A. Rader who, prior to his new assignment, served as Air Officer of the 7th Corps Area with headquarters at Fort Omaha, Neb.

REVIEW of WORLD AERONAUTICS

German Aviation Might be Reparations Penalty

French military aviation since the armistice has cost the nation 2,000,000,000 francs, and when a few years hence the motors now in use, taken from war stocks, must be replaced the aviation budget must be increased to at least 1,000,000,000 francs a year. Taking these figures as a basis, the Echo de Paris suggests France demand that Germany cease the construction of commercial aircraft, as another "productive guaranty," declaring that the sums thus saved for Germany not only would provide a huge economy for Germany, but would also enable the French budget to be materially reduced on account of the absence of costly competition.

The Biard-Supermarine Records

Four more World's Records, to the credit of Great Britain, have been officially granted by the F. A. I. for the performances put up by Capt. Biard, on the Supermarine-Napier flying boat, in the Schneider Cup Race last year. These records are for 200 kms., 100 kms., duration and distance.

London to Denmark by Air

The Instone Air Line, London, announce that negotiations are being completed with Det Danske Luftfartselskab, the managing director of which is Mr. Willy Woolf, for through air bookings from Copenhagen to London *via* Cologne. It is estimated that the new service, which, it is hoped, will be started in the early spring, will save 18 hrs. on the trip between London and Copenhagen.

The Speed Record of the Italian Flying Boat S-51

On December 28, 1922, before the representatives and the officials of the F. A. N. I., the pilot Passaleva made the tests prescribed to determine the speed record according to the F. A. N. I. rules, with the flying boat S-51.

The straight runs of a Kilometer were 12. In the case of several tests the rules allow to choose four of them providing that they are consecutive.

The times on the 12 runs were as follows:

1st Test	13	seconds
2nd "	13 1/5	seconds
3rd "	12 2/5	seconds
4th "	13	seconds
5th "	13	seconds
6th "	13 3/5	seconds
7th "	12 3/5	seconds
8th "	13 2/5	seconds
9th "	12 4/5	seconds
10th "	13	seconds
11th "	12 4/5	seconds
12th and last Test	13	seconds

To calculate the average speed the last four tests were chosen giving a total time of 51 4/5 seconds and 12 19/20 seconds on each kilometer run.

The average speed resulting from the time of the chosen tests is Km. 277,992 per hour (174 miles per hour).

In one of the tests owing to the favorable wind the speed obtained was more than Km. 280 per hour.

International Air Congress, London, 1923

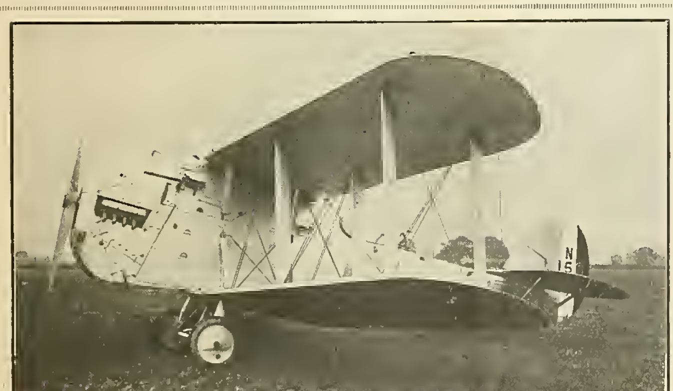
The Congress which is taking place in London on the invitation of the British Government, will be held from Monday, June 25th to Saturday, June 30th, 1923 inclusive.

The principal object of the Congress is to give an opportunity for international discussion of the various problems in connection with aircraft design, construction and operation. The papers to be read will be divided into 4 Groups which will hold Sessions simultaneously: A. Aerodynamics, Aeroplane Construction, Research Methods, &c.; B. Power plants, Fuels, Lubrication, Airscrews, &c.; C. Air Transport and Navigation; D. Personnel, Air Tactics and Strategy (as affecting Commercial design), Airship Design and Construction, &c.

An opportunity will also be afforded of visiting various British aircraft establishments and factories, and the Air Ministry have arranged to hold the Royal Air Force Pageant on June 30th, the last day of the Congress. Membership is open to nationals of all countries which are represented on the Federation Aeronautique Internationale or which are signatories of the International Air Convention. The subscription for Membership will be 1£ (or its equivalent in foreign currencies) while members of the family of a Member may join as Associate Members for a subscription of 10s. 0d. (or its equivalent). An Official Report of the Congress will be published and may be subscribed to for an additional 1£.

The official languages of the Congress will be French and English.

Lt. Col. W. Lockwood Marsh has been appointed General Secretary of the Congress and the official address is 7, Albemarle Street, London W. I., England.



Gunnery fleet spotter built by Blackburn Aeroplane Co. for the British Government. It is equipped with a Napier Engine

Aviation in Syria

The Syrie-Liban Aero Club, recently formed with the object of developing aviation in Syria, is to be affiliated with the Aero Club of France and a certain liveliness in aviation matters may be expected in this country in the near future. The French Air Service has already organized 50 landing stages, 10 of them fully equipped as regards shelters, revictualling and repairing arrangements.

The principal lines thus prepared are Alexandretta, Aleppo and Deir-ez-Dor, on the route to Bagdad; Aleppo, Hama, Homs, Rayak, and Damascus towards Palestine and Egypt; Damascus, Palmyra and Deir-ez-Zor for the direct crossing of the Syrian desert in four hours; Alexandretta, Latakia and Tripoli for the coastal line.

Spanish Activity

Authorization for the purchase of large quantities of aeronautic equipment by the Spanish Government was granted on November 20th. The specifications called particularly for spare parts for the Bristol, the DeHaviland, and various French planes. Airdrome equipment is also to be purchased, including installations at Cuar to Vientos, Getafe, Los Alcazares, Leon, Granada, and several airdromes in Africa. Two Breguet airplanes, with ambulance equipment, were ordered by a separate decree. Apparatus for airplane photography was also purchased from a German firm, one set at a cost of 50,000 pesetas and another at 67,000 pesetas.

It is reported that there is still a considerable sum to be spent from the appropriations in order to prevent the money from reverting to the treasury, which is considered undesirable.

Argentina Air Mail

By arrangement with the Aerial Transport Co. of the River Plate, the Argentine Post office has established a daily air mail service between Buenos Aires and Montevideo, the planes to carry passengers as well as mail. Three hydroplanes will be used, and the flying time will be about one hour.

In addition to the regular postal rate, letters and newspapers will carry a surtax of 30 centavos for each 20 grams or fraction thereof; on books and similar printed matter the surtax will be 30 centavos for each 65 grams. One of the planes to be used is already on hand, and the service should be in operation by the first of the year.

The Progress of Civil Aeronautics in Italy

(Special to Aerial Age)

The present situation of aeronautics in Italy is not easy to explain.

The recent abolition of the "Comando Superiore d' Aeronautica" which up to the present has acted as Air Ministry, is a step forward in the reconstruction of Italian Aeronautics, and it is hoped that the measures taken by the new cabinet will put Italian aviation in line with the other nations. But this, of course, is only a beginning.

Italy has never had an air policy. She has always "muddled through" without a policy. Manufacturers were not aided nor were private ventures encouraged. Subsidies were always very small and seldom granted with sound judgment, resulting in the formation of a lot of small firms without sufficient resources or capital, to the detriment of companies already engaged in the manufacture of planes.

Aeronautical propaganda, moreover, is neither sufficient, nor intelligently constructed. The Italian press makes no attempt to support a domestic industry.

As to the aircraft industry for civil purposes, this is chiefly devoted to the transformation of military types into commercial machines. And finally if we add that commercial machines are not reliable and that material prices are unusually high, you will have an idea of the confused situation of Italy's aeronautical industry.

The National Aeronautical Corporation

As affairs stand it is not difficult to understand that an unique organization is required for the stablization of civil aeronautics. This organization is the National Aeronautical Corporation which has the support of the Fascisti Party.

The C. N. A. "National Aeronautical Corporation" already comprises the largest and most reliable organization in Italy.

The possibilities of such a Corporation depend on the extensiveness of the resources which every incorporated society must have, and on the likelihood of coordinating the advantages to be gained thereby.

This corporation will incorporate the firms shown hereunder:

COMPAGNIA NAVIGAZIONE AEREA, Ltd., established 1921—devoted to the exploitation of national and international air lines with aeroplanes, hydroplanes and airships. Their managers think of starting international lines plying between Central Europe, the North African Continent, the Balkans and especially South Russia, Ukraine and Caucasia. These countries, rich in raw-products and in goods of every kind, are comparatively near from the geographical point of view but practically far owing to the slowness and uncertainty of the existing means of transportation. Lines based on these geographical and economic fundamentals should pay their own way today and reap tremendous benefits in the future. In this connection we must consider that aerial navigation is not yet in such a position as to meet the competition of the other means of transportation, for the advantageous coefficient "speed" is superseded by the coefficients "danger" and "cost". Consequently in the manager's opinion, every line operating in competition with steamers or railways is, generally speaking, unprofitable and unimportant. The air lines operating over the Nice-Athens and Rome-Milan routes, for example, we would expect to find in precisely such a condition.

COMPAGNIA NAZIONALE AERONAUTICA (formerly Coöperative Nazionale Aeronautica), established 1920. Starting, organization and exploitation of flying fields; aeronautical instruction, flying school, pilots' training, pleasure trips, aerial photography, aerial advertising, are some of the branches of the aforementioned company. The first thing for this society to do is to supply the country with flying fields. These are to be taken over from the military administration, for the exploitation of the fields must be a civil service and bear a commercial atmosphere. The government, moreover, must help the aeronautical schools.

L'AREA—Aeronautical Information Agency, established 1922. As the greatest part in popularizing aeronautics is being played by the press, this agency issues one or two bulletins daily which are sent free of charge to all the newspapers and agencies of Italy and foreign countries. The Italian press has welcomed this movement favorably and is accustomed to go to the "Area" for its aeronautical information.

PEGNA BONMARTINI CERRONI—Naval and Aircraft Manufacturing, open partnership established 1922. This is the only firm in Italy devoted to the construction of new types of machines, especially for civil and commercial purposes. Though it is the youngest Italian aircraft firm, it is having a very large share in Italian aeronautics, not only because the designer of the well known PRB Flying Boat is its manager, but because it is working in partnership with the National Aeronautical Corporation. The construction of newest types of military machines was recently awarded to it by the Ministry of War.

NATIONAL AERIAL BANK (to be established). The Count Giovanni Bonmartini, an Italian Pioneer, is the promoter of this bank which has the full approval of the Italian aeronautical world. We gather this information from the pamphlet issued by the Count Bonmartini.

The author, who can call himself an expert in this matter, does not approve of the foreign systems of subsidising aeronautical companies. In his publication he has pointed out that subsidies undermine organizations, engender speculation, put the government to a real expense and do not help the progress of aeronautics. This being the case, the government might form a bank from which important national companies could borrow funds when necessary. Such a loan should carry no interest for the first ten years, after which date interest should be very low and afterwards progressively higher.

By granting these loans the government would not *lose* money as other nations do under the system of subsidies. The government should grant an adequate subsidy only for the postal air service.

These are the general bases on which the bank in question is to be formed. Other interesting details are dealt with by the author in his publication (1) especially with regard to the banking operations.

An aviation Insurance Society should be allied to this bank, insurance being compulsory for all aeronautical parts and materials.

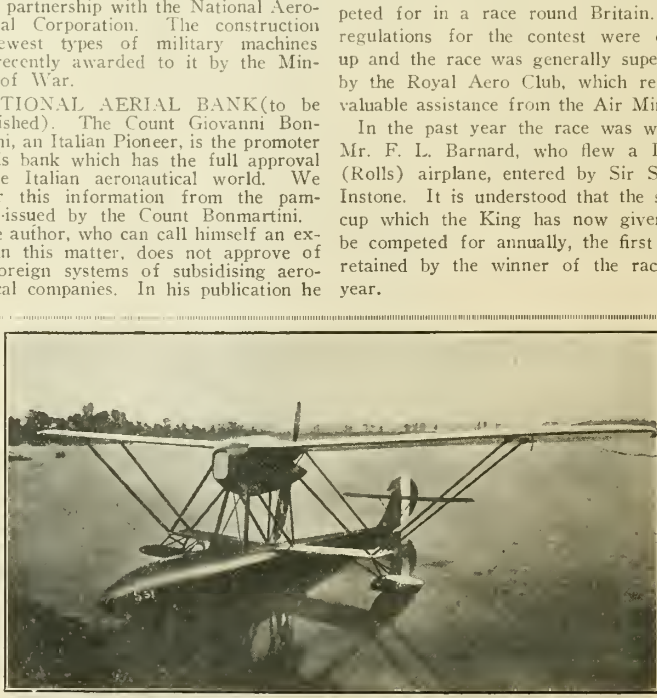
Alighiero Baciocchi

Race Around England to Be an Annual Event

The Royal Aero Club of Great Britain has received notification from the King that he will present a cup for the air race round England this year.

The race for the King's Cup was inaugurated last year when the King gave practical expression to his interest in aviation by presenting a trophy to be competed for in a race round Britain. The regulations for the contest were drawn up and the race was generally supervised by the Royal Aero Club, which received valuable assistance from the Air Ministry.

In the past year the race was won by Mr. F. L. Barnard, who flew a DH4A (Rolls) airplane, entered by Sir Samuel Instone. It is understood that the second cup which the King has now given will be competed for annually, the first being retained by the winner of the race last year.



The Italian Savoia S51

ELEMENTARY AERONAUTICS and MODEL NOTES

Two Efficient Models by Bertram Pond.

THE two tractor models, illustrated in the accompanying line drawings, are representative of Mr. B. Pond's ability as a light-weight tractor designer. Altho many of the other Illinois Model Aero Club members are expert at building successful models of extreme light weight, the two shown, more particularly the indoor tractor, are among the most noteworthy.

The indoor tractor has remained in the air, during a contest, for 170 seconds. The speed in flight is about equal to the rate the average person walks. The slow speed and long duration are not due only to the use of balsa wood for the frame and propeller, but also to the builders knowledge and experience in balancing the machine properly. The summary of weights is interesting:

Rubber elastic	6/100 ounce
Motor base	5/100 ounce
Propeller	3/100 ounce
Wing	5/100 ounce
Total....	19/100 ounce

The wings have a total area of 62 square inches, so the loading is therefore .441 ounces per square foot.

Only two strands of one-eighth inch rubber are used. The propeller was given 1125 initial turns its record breaking flight.

Light tissue paper covers the wings and tail surfaces. No dope is used. Bamboo frame work. The propeller is 12 inches in diameter and very thin in section. Amberoid cement is used in making all joints and for attaching the propeller shaft to the propeller.

The skid shown in dotted outline on the drawing shows a suitable arrangement for rigging the machine for rising off the ground.

Ponds Hollow Spar tractor, also shown in one of the drawings holds the unofficial distance and duration records of 6,300 feet and 522 seconds. Officially this model is credited with a distance flight of 2,465 feet.

Weight specifications are as follows:

Total weight	1.47 ounce
Weight of motor base & fin	.35 ounce
Weight of wing clips	.27 ounce
Propeller weight	.15 ounce

The dimensions are given on the plan drawings. Six strands of 3/16 inch flat rubber are used for motive power. From 800 to 1200 turns are given the propeller.

Additional details of these machines were given in the August 1922 issue of AERIAL AGE. All letters concerning these two record-breaking models should be addressed to the designer, M. Bertram Pond, Illinois Model Aero Club, Auditorium Hotel, Chicago, Illinois.

RECENT ACTIVITIES OF THE A. E. S.

The Aeronautical Engineering Society at the Massachusetts Institute of Technology has held several meetings during the present school year. An account of the first, held Nov. 15, 1922, has already been sent to AERIAL AGE. The speakers for this meeting were Otto C. Koppen and Harry C. Karcher of the Society's glider team, and Prof. E. P. Warner. Motion pictures of last summer's gliding competitions in France and Germany were shown.

On Dec. 6, an informal conference on motors was held in the R. O. F. C. Air Service room at M. I. T., where over a dozen airplane engines of the leading types were on exhibition. The speaker for the evening was Mr. Warren Noble, chief engineer of the Kinney Manufacturing Co. of Jamaica Plain, Mass., which is developing new types of aeronautical engines for the U. S. Navy. Mr. Noble discussed in considerable detail many of the problems met in developing new motors, pointing out how particular difficulties had been discovered and overcome. Following Mr. Noble's talk, those present had an opportunity to ask questions and to join in an informal discussion of aviation engines.

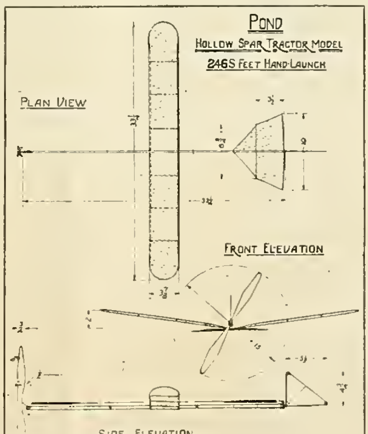
The first meeting this year was held on Jan. 11. The speaker was Prof. L. S. Marks of Harvard University, author of "Airplane Engines." Prof. Marks spoke on the subject "Supplying Fuel to Aeronautical Motors," with special emphasis on carburetor and manifold design. This was followed by an informal discussion of the subject among members of the Society and Prof. Marks.

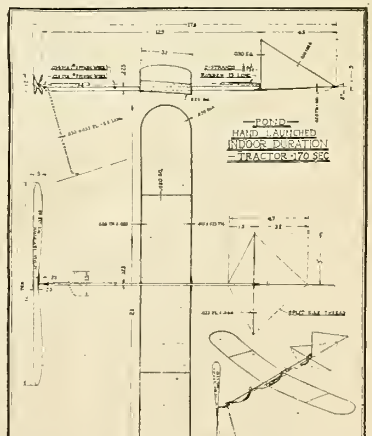
A meeting open to all M. I. T. students and the public, was held Jan. 25. The first speaker was President S. W. Stratton of the Massachusetts Institute of Technology, who, until recently assuming the presidency of the Institute was a member of the N. A. C. A. and Chief of the Bureau of Standards, which bureau was first organized by him and owes its present position of importance very largely to his efforts in developing it. Pres. Stratton spoke on his work in the N. A. C. A. and the Bureau of Standards in connection with aeronautics.

Pres. Stratton introduced Major General Mason M. Patrick, Chief of Army Air Service, who was the speaker for the evening. Gen. Patrick opened his address by giving a short history of aviation, and went on to tell of the accomplishments of the Air Service during and since the war, and the developments which are being carried on at present. He pointed out the important part played by airplanes in war, stating that the result of any future war would depend very largely upon the effectiveness of the Air Service, upon which, both land and naval activities are dependent. He described the Air Service flying tanks which are armored against machine gun fire and capable of carrying large caliber non-recoil cannon. Mention was made of the new dirigibles which will be able to fly to the north pole and back, and can be used to transport troops and supplies and even small fighting planes which can drop from the mother ship to engage in combat, and then return to her, being picked up by hooks suspended from her keel. Moving pictures of bombing tests, taken from the bombing planes themselves, were thrown on the screen, showing operations against battleships.

The second part of Gen. Patrick's talk was on helicopters. Moving pictures were shown of several types in flight, which showed them to be decidedly unstable. The official Air Service films of the new de Bothezat helicopter which recently made a record flight at McCook Field, were thrown on the screen. These pictures, which had been shown only once previously, showed the remarkable stability of the machine, which flew with apparent ease.

The next speaker was Prof. E. P. Warner who spoke on the "Operation of Commercial Air Lines." His talk was a detailed summary of his observations while travelling thru Europe last summer making a study of European airways, on which he flew some two thousand miles. His talk was illustrated with moving pictures and lantern slides showing the equipment of airplanes and air ports abroad. Prof. Warner explained the steps which are necessary before passenger lines can





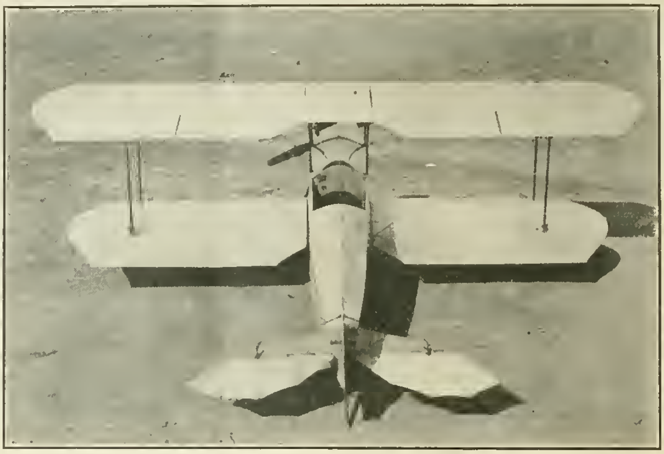
Two models by Bertram Pond

be operated successfully on a large scale in this country, and pointed out the promising future which lies open to commercial aviation once these steps are taken.

Several reels of motion pictures of the glider contests in Europe were thrown on the screen showing the M. I. T. gliders, which were built by the Aeronautical Engineering Society, in flight. Some of the films had just arrived from Europe and were shown for the first time in this country. These pictures concluded the program for the evening.

The A. E. S. is conducting a glider design competition open to all students at M. I. T. This competition is similar to the one held last year by the Society, and it is expected that the winning design will actually be built, although it has not been determined whether or not the Society itself will undertake the construction.

With the consent of Prof. Warner, the Society has had several complete sets of photographs printed which were taken by Prof. Warner at last summer's gliding meets in France and Germany, and has offered these photos for sale. Several hundred have been sold so far. These photographs show all the prominent gliders taking part in the contests, most of them in flight. The set of photos forms a very complete pictorial record of the gliding meets.



The Houpizine constructed by Clarence Melton

Melton's Houpizine

Now that the old flivver has taken to the air we may be able to fly around a bit without waiting for the millennium municipal and landing fields. Mr. Melton, Clarence to be exact, of 3507 East 34th St., Kansas City, Mo. has bone and did it. Here is what an automobile mechanic did—Mr. Melton—in his spare time, doing the work himself including the welding and the woodwork. He took a Ford engine, turned it end for end to deceive Henry, mounted a home-made prop, disposed it in the bow of a fuselage, added some wheels and at last a pair of wings, and it flew—just like a regular aeroplane designed by Bothezat or Willard or Shaw or anybody. Some Army officers flew it and reported a very fair performance or at least as good as could be expected outside of McCook Field.

Here is the dope. The power plant is a remodeled Ford engine, in which a 16-valve head was substituted. The flywheel and transmission were removed and an airscrew placed where the transmission originally was. Ignition is by a Dodge magneto supported on a shelf to the rear of the engine. The throttle is operated by a simple direct-connected wire extending from the carburetor bell crank through the instrument board and terminating in a small button. The fuel consumption is 3 gallons per hour. The airscrew of 6.5 ft. diam. by 3.5 ft. pitch furnishes 275 lbs. thrust.

Following are the general characteristics: Upper span 20 ft. lower 18 ft.; Chord 4 ft. 4 in.; gap 4 ft. 4 in.; stagger 10 in.; sweepback, lower, 3°, upper, 0°; dihedral, very small in lower wing; total supporting surface 167 sq. ft.; flying load 4.5 lbs. per sq. ft.; 18 lbs. per h.p., loaded with pilot; maximum speed 72 m.p.h.

(*Concluded from page* 186)

by the government with other means of transportation *at such rates that passengers and merchandise can be attracted to aerial lines.*

As soon as it is possible to do so, let us sell on easy terms to privately owned aerial operating companies, under proper guarantees, *with* or *without* a contract for carrying mail, the lines that we have started and let them make it their business to see that they pay dividends to the stockholders, *with as little government interference with the conduct of their business as it is possible.*

Let us keep in mind that if we want to have military pilots and good aircraft in time of war we must have good civilian pilots and a flourishing aeronautical industry in time of peace. We do not want to spend more than we have to for military and naval aeronautics in time of peace if we can create the great school of commercial aeronautics for our pilots and a powerful organization of aircraft manufacturers that will turn out military and naval aircraft in time of war just as so many Ford cars.

Gentlemen, this can be accomplished by you with the power that has been conferred upon you by the people. It is up to you to decide if we are going to compete with European nations in the mad race for aerial armaments or else if we are going to create a great industry that will enhance our commerce in peace time and will enable us to protect our land from any possible foreign invasion in time of war.

It is also up to you to take the responsibility of doing nothing for aeronautics which has been the unfortunate record of the Sixty-seventh Congress.

We propose to do our duty by presenting to you, and to the people at large, facts, suggestions and constructive criticisms and we request your action which we confidently expect will not be delayed any further.

$3500 in Prizes for Users of Valspar

Nearly everybody knows about Valspar and millions are using it. This wonderful waterproof varnish has proved its worth and quality under circumstances and conditions that are nothing short of amazing.

Thousands of unsolicited letters have reached us from people wishing to relate unusual Valspar experiences. These letters furnish overwhelming testimony of Valspar's marvelous durability and its astonishing resistance to water, heat, acids, alkalis.

And we are convinced that thousands of other Valspar users have had experiences just as interesting. We want to know of these incidents. Accordingly we are offering several thousand dollars in cash prizes for letters telling of experiences with Valspar.

List of Prizes

Prizes for Valspar Experiences

1st prize $500.00
5 prizes of $100.00 each
10 prizes of $50.00 each
100 prizes of $10.00 each
200 prizes of $5.00 each
316 prizes in all—Total value of prizes $3,500.00

Prizes for Valspar Dealers

1st prize $250.00
5 prizes of $100.00 each
5 prizes of $50.00 each
10 prizes of $10.00 each
80 prizes of $5.00 each
101 prizes in all—Total value of prizes $1,500.00

Contest Closes April 30th

VALENTINE'S VALSPAR
The Varnish That Won't Turn White

For Instance

That you may understand exactly what we have in mind, we give the following actual experiences as examples:

1. C. K. Perry of Marshfield, Oregon, wrote about a Valsparred dining room table which as the result of a fire last July, was drenched with water mixed with lime and charcoal. The under part of the table (which was not Valsparred) turned white as snow—the Valsparred top, when washed, was found to be in perfect condition.

2. Mr. J. H. Audibert, of Fort Kent, Me., varnished four axe-handles, each with a different Varnish-Stain including Valspar Varnish-Stain. He writes: "The cheapest stain looked all right and dried quicker, but after putting all the handles in a pail of ashes mixed with boiling water, I found the Valspar was the only one that stood the test."

3. One stormy day last November, Mrs. J. B. Kirk of Hackensack, N. J., had to leave her car out in the driving rain and sleet. (Fortunately, her husband had put two coats of Valspar Enamel on it the Spring before.) "After the storm," she writes, "it looked like an iceberg and I thought the finish would be ruined. But the ice and water didn't hurt it at all and today the car looks as fine as when the enamel was first put on. Our garage man marvels at it, because his own car, which he refinished with another make of varnish, looks so shabby and dull."

Unique Qualities of Valspar

Valspar is made in three forms—Valspar Clear Varnish, Valspar Colored Enamels and Valspar Colored Varnish-Stains. All of these can be freely washed with hot water and soap; they never turn white; they resist the action of acids, alkalis and oils. They are very durable; they don't chip, crack or peel. They dry in any weather—dust-free in two hours and hard in twenty-four.

About the Uses of Valspar

Clear Valspar is, of course, used for finishing floors, all kinds of indoor and outdoor woodwork, furniture, boats, refrigerators, linoleum, and for the many other uses of varnish.

Reg. U. S. Pat. Off. *The famous Valspar Boiling Water Test*

Valspar Varnish-Stains possess the same qualities as clear Valspar, but you stain and varnish with one stroke of the brush. They come in six permanent colors. Absolutely waterproof and very durable, they are unequalled for finishing floors, front doors, porch furniture, and all other woodwork that requires staining.

Valspar Enamels answer the need for a really waterproof enamel. They are made from the finest pigments carefully ground in clear Valspar, thus combining Valspar durability with exceptional beauty of color. Valspar Enamels are absolutely unsurpassed as an automobile finish and for wood, metal and all other surfaces where enamel is used. They come in 12 standard colors.

What Can You Tell Us?

If you know an instance where any (or all) of these three forms of Valspar has proved its durability and waterproofness under unusually severe conditions of wear, or under some extraordinary circumstance, we ask you to write us about it. And if you have photographs which add interest to your story we will be glad to receive them.

It makes no difference which form of Valspar has been used—it makes no difference what kind of a Valsparred surface it is. Just tell us the facts.

Requirements and Prizes

There are no restrictions, no intricate qualifications. Write your letter in ink and use *only one side of the paper*. These are the only requirements—with the understanding, that the incident told about actually occurred prior to the first announcement of this contest. And that we shall be allowed to use for publicity purposes as we see fit any letters submitted.

$500 will be awarded to the contestant who sends the letter that the judges agree is the most interesting of all. 5 prizes of $100 to those whose letters stand next in interest—ten $50 prizes, one hundred $10 prizes, and two hundred $5 prizes will also be distributed—more than three hundred (300) prizes in all.

The judges of the contest will be Mr. Lawrence F. Abbott, President of The Outlook; Miss Martha E. Dodson, Associate Editor of The Ladies' Home Journal; Miss Gertrude B. Lane, Editor of the Woman's Home Companion.

We suggest that letters do not run more than 250 words in length, but length or literary style will have no bearing on the award of prizes.

All letters must be received by April 30th.

Address your communications to Valentine & Company, Prize Contest Department, 51 East 31st Street, New York City, N. Y.

Write Your Experience Now

Let us hear what you know about Valspar. Don't consider your experience as too trifling or commonplace, write us about it. Not everybody can relate a startling occurrence, and it's more than likely many of the prizes will be won by simple, matter-of-fact stories.

Don't let this chance slip by. A few minutes spent in writing your letter gives you a splendid chance to win a substantial prize. Send us *your* story. Send it today.

Prize Contest Department
VALENTINE & COMPANY
51 East 31st Street, New York

Every Live Dealer in the United States Sells Valspar

SPECIAL DEALER WINDOW DISPLAY CONTEST

In addition to the contest described above, which is open to everyone, including all dealers, there will be a special contest for dealers only.

$1500 IN PRIZES for photographs of the best Window Displays of any or all of the following—Valspar, Valspar Varnish-Stain and Valspar Enamel. Only those dealers who have Valspar in stock or have ordered same at the time of the first announcement of this contest are eligible.

Prizes will be awarded as follows: First prize $250; 5 prizes of $100 each; 5, $50 prizes; 10, $10 prizes, and 80, $5 prizes—101 prizes in all. All letters and photos must be received by April 30th, 1923.

Save this page—and work for a prize

AVIATION

Big Pay *Opportunity* *Success*

AIRPLANE EXPERTS EARN $2,000 to $10,000 A YEAR

Aviation to-day offers the most wonderful opportunities the world has ever seen. The marvelous growth and development of Commercial Aviation has created an unheard of demand for men who are trained in some branch of this great industry. A demand for Airplane Experts.

$40.00 to $200.00 A WEEK IS EASY

Capable mechanics, Engineers, draftsmen, designers, constructors, inspectors—men who may be classed as Airplane Experts earn $40 to $200 a week—even the "screw-driver" mechanic makes big money today.

BE AN AIRPLANE EXPERT

NOW is the time to qualify. Let me train you in your spare time at home. I train you in modern methods of design, manufacture, operation and maintenance, fitting you to hold down a good job in Aviation as an Airplane Expert. My course in Applied Aeronautical Engineering has placed hundreds of men in Aviation—on the road to success—why not you?

FREE AIRPLANE PARTS

Because my course is the most practical method of instruction by mail ever devised, you must work with actual airplane tools, wires and fittings in your *own home*, with your *own hands*. You learn and apply theory, design and construction on an actual experimental airplane built to scale—not a toy. This wonderful outfit is absolutely free.

MONEY BACK GUARANTEE

So sure am I that I can make you an Airplane Expert capable of earning big money I absolutely guarantee to pay you back every penny if you are not entirely satisfied with my instruction.

MAIL THE COUPON NOW

Let me send you my illustrated booklet and show you how easily you can qualify for a "man's size" job in Aviation. Mail the coupon NOW to

L. B. Coombs, Chief Engineer
THE CENTRAL AIRPLANE WORKS, 3254 Lincoln Ave., Chicago

L. B. Coombs, Chief Engineer 3254 Lincoln Ave. Chicago, Ill.

Dear Sir: Kindly send me free of charge your booklet on Aviation and tell me how I can become an Airplane Expert.

NAME____________________

ADDRESS____________________

Service and Prices Both Important

10c or $10,000.00 it makes no difference. Regardless of size your order will receive the kind of service that only years of experience in this business can give. You can depend on us for Quality, Service, Satisfaction.

Propellers for 0X5

Make	Wood	Copper Tipped	Type	Diameter	Pitch	Price
Buffalo	Mahogany	"	Toothpick	8'4"	5'3"	$15.00
Flottorp	Birch	"	Toothpick	8'4"	5'	20.00
Flottorp	Birch	"	D-5000	8'	5'3"	20.00
American	Oak	"	Toothpick	8'4"	5'	15.00
Paragon	Oak	"	"	8'3"	5'	15.00
Liquid Carbonic	Birch	"	"	8'	4'	15.00

Radiators for 0X5

Rome Turney, square core weighs 56 lbs.	15.00
Mayo, square core weighs 50 lbs.	15.00
Harrison, cartridge core weighs 44 lbs.	15.00

These radiators are new and guaranteed to cool an OX5. They have connections for thermometer.

Instruments

Oil gauges, O-120 lbs. luminous dial	$ 2.50
Air gauges, O-10 lbs. luminous dial	2.50
Altimeters, Taylor, 3½" luminous dial, O-25000 ft.	3.00
Altimetera, Zenith, 3½" luminous dial, O-28000 ft.	3.50
Compass, G. E. Army type	15.00
Inclinometers, Taylor or Elliott, bubble type	2.00
Tachometer Heads, Jones, Johns Manville, Warner, NCR	5.00
Tachometer Heads, French "Jaeger," with short shaft	5.00
Tachometer Heads, for German motors	3.00
Tachometer Head, for English motors	3.00
Thermometers, Boyce distant type, 15' tube	7.50
Hand Air pumps, brass barrel	1.00

Write for our No. 5. Price List and tell us how we can serve you better.

JOHNSON AIRPLANE AND SUPPLY CO.

The Aeronautical Supply House

DAYTON, OHIO

$100.00 A Day as an Income Tax Consultant is not unusual and hundreds are paid $25.00 to $50.00 per day. Our Course in Federal Tax Accounting will help you attain such a position. Write The Walhamore Institute, Lafayette Bldg. Phila. Pa. Dept T.

$3,000 to $25,000 are the salaries paid to leaders of big business—you study their methods through our Course in Business Administration. Write The Walhamore Institute, Lafayette Bldg. Phila., Pa. Dept B.

$5.00 An Hour represents the regular charge of the Advertising Writer and Specialist. There's a Walhamore Course in Advertising for you. Write The Walhamore Institute, Lafayette Bldg. Phila., Pa. Dept. A.

$3.00 to $25.00 for Spare Time Snap Shots turns your camera or kodak into a money maker. No work more enjoyable than Photographic Journalism. Write the Walhamore Institute, Lafayette Bldg. Phila., Pa. Dept. P.

$200 A Day For A Little Poem is said to be Walt Mason's daily income. Our Course in Newspaper Correspondence and Journalism tells you how its done. Write The Walhamore Institute, Lafayette Bldg. Phila., Pa. Dept. J.

$10,000 A Year As A Salesman. Earned by many. Study the subject and join the ranks. Write the Walhamore Institute, Lafayette Bldg., Phila., Pa. Dept. S.

$5,000 or more as a Mail Order Merchant may be earned in your own home or store. Write The Walhamore Institute, Lafayette Bldg. Phila., Pa. Dept. MO.

Quality Speed Bargains

New Completely Equipped 3 Psss. Standard Airplanes with 150 H. P. Hispano installed, at Houston, Texas	$1200.00
New OX5 Standard Airplanea at Houston Complete	850.00
New Thomss Morse Scout with new 80 LeRhone, New York	700.00
New 150 H. P. Model A Hispano Motors, New York	650.00
New 160 H. P. Mercedes Motors, New York or Texss	450.00
New OXX6 100 H. P. Curtiss Motors Complete	625.00
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New 80 H. P. LeRhone Motors	75.00
New 160 H. P. Beardmore Motora	400.00
New 300 H. P. Liberty Motors	800.00

OX5 and OXX6 Vaive Action assemblies $5; Burd high compression piston rings for OX5 10c; for OXX6 32c; OX5 cylindera $6.50; OX5 cylinders new but jsckets slightly jammed $3.50; pistons $2; piston pin 60c; exhaust vaives 50c; intake or exhaust gaskets 10c; Canuck or D upper linen wing covers $17.50; cotton $15; Canuck lower linen or cotton wing covers $12; AA grade linen 90c yd.; A grade cotton 55c yd.; cotton tape 6c yd.; linen tape 8c yd.; Victor Cord 1c yd; Axlea $2.50; Rotary Map Cases $2.50; Tan Leather new heimets $4.50; NAK Resiatal Gogglea, non-shatterable, $5; Jumbo Resistai Goggles $3.50; New 26x4 wheel, alightly used, Goodyear Cord Casing and new tube $6.50; new tube $1. New Zenith Carburetors $15; New Berling Magnetos $20; AC Spark Plugs 20c

Airplanes, Flying Boats, Motors, and All Manner of Aircraft Supplies and Parts for OX5, OXX6, Canuck, JN4D and J-1 Standard

New HS2 Flying Boats complete, crated, less Motor	$1,200.00
New Liberty Motor for HS2 Boat	800.00
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New OXX6 Motor for MF Boat	625.00

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15.	Axle, struts (interplane) with fittings, pair of landing vees, each	2.00
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17.	Canuck wing wiring blue print	1.50
18.	New Flottorp (toothpick)—genuine—8' x 5' 3"—copper tip	10.00
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JN4-D

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25.	Covered elevators	4.00
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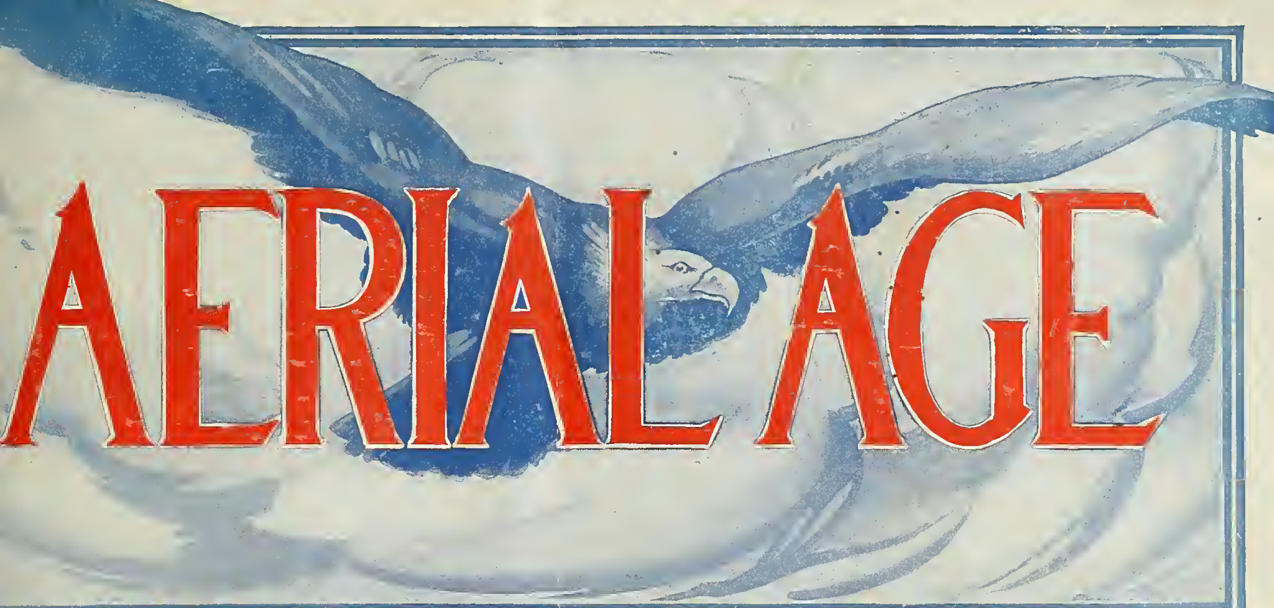

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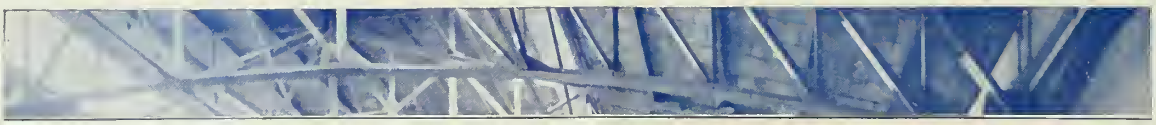

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National Aeronautic Association of U. S. A., (Inc.)

National Headquarters 26 Jackson Place Washington, D. C.

To the Reader:—

Do you believe with the Engineers, Economists, and Statesmen, that the advancement of civilization depends upon the development of transportation and communication?

Do you believe that the result of the people's progress is their use of these agencies?

Do you believe that the superiority of the civilized man over the savage is due to his use of mechanical devices?

Do you agree that Aviation is one of the fastest methods of transportation?

Do you agree that Aviation is a supplemental agency to all surface methods of transportation?

Do you agree that the United States, the birthplace of Aviation, should lead the world in its development?

Do you believe that America should be first in the Air?

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Official Photograph U. S. Navy

The C-7 helium-filled Navy blimp salutes the White House when passing over Washington

Official Photograph U. S. Navy

Remarkable aerial photograph of the Pacific Fleet Destroyers laying a smoke screen with the "eyes of the Navy" the F-5-L's of the Pacific Air Force, watching high above

U. S. Destroyers laying a smoke screen, as seen from the air

AMERICA TO CALL WORLD CONGRESS ON AERONAUTICS

THE National Aeronautic Association of the U. S. A. has decided to call an international conference of scientists, engineers and technical men interested in aeronautics and manufacturers of aircraft and accessories for the purpose of reaching a world understanding in research work and the technical side of aeronautics. The conference will be held in the United States, probably in Washington and before the close of this year, under the auspices of the National Aeronautic Association, which represents in America the Federation Aeronautique Internationale, whose headquarters are at Paris.

In inviting representation from all nations it is believed that aeronautics has now reached such an important stage of development that the cordial coöperation of all countries interested in the solution of outstanding problems must be secured. Emphasis is laid on the purpose of establishing through personal contacts in a World Congress a better spirit of interest and understanding for world progress in aeronautics.

The progress of commercial aviation in the United States and all other countries, according to an announcement of the National Aeronautic Association, depends in a very great degree upon the closest relations between scientists, engineers, technical men and the manufacturers for the purpose of solving the many technical problems that are interwoven with aerial transportation.

Aeronautics is not only a national proposition connected with the defense and the commerce of any one country, but it is largely an international proposition. It interests the people of the world because it opens up a new and tremendously important field of activities in the transportation of passengers and merchandise all over the world. For these reasons the National Aeronautic Association believes that all obstacles which are at present hindering the fullest development of aeronautics should be removed through the active coöperation of all concerned. General interest in standardization because it will enhance reliability and safety is more widespread than ever as a result of the membership campaign throughout the country of the National Aeronautic Association, which is enrolling in every state men and women who are confident that the United States can and will take the lead in aerial transportation.

One of the main obstacles today is the lack of uniform standards in the scientific field of aerodynamics and in the engineering end of aircraft design and construction. In research work the difference in languages in the various countries is further aggravated by a very serious lack of agreement on the interpretation of the results obtained by the aeronautical research organizations throughout the world. This has resulted in confusion as to the meaning of symbols, definitions, methods of graphic representation, etc. and has prevented students and aeronautical engineers from benefiting to any appreciable extent from the work done in the scientific and technical field of aeronautics outside their own country.

Upon the adoption of standards depends in very great measure the element of safety in air transportation. It also has an important bearing upon the construction and operation of aircraft. The National Aeronautic Association anticipates that in calling an international conference it will have the hearty support of representatives of the various engineering organizations and the aircraft manufacturers of the United States and of the chiefs of the government departments utilizing aviation, who will recognize that through such a congress the desired results may be obtained in the shortest possible time and by an interchange of ideas and experiences among those delegates who attend the sessions.

William Knight, vice chairman of the Scientific Research and Industrial Relations Committees of the Association, will be actively in charge of the preliminary arrangements for the conference. Mr. Knight has been technical assistant in Europe to the National Advisory Committee on Aeronautics, and during the war was attached to the technical section of aviation of the American Expeditionary Forces in France.

NATIONAL CAMPAIGN TO ORGANIZE AERIAL FORWARD MOVEMENT

THE urgency of action which brought together a large and representative group of forward-looking Americans at Detroit last October, culminating in the creation of the National Aeronautic Association of the U. S. A., pledged to a comprehensive, definite and continuing policy of aeronautic development in this country, has in five months spread from coast to coast. It is already demonstrating a national sentiment. This was quickly recognized by the press and today newspapers everywhere are doing their patriotic part in overcoming a general bewilderment that was a natural result of the tremendous spur given aeronautics in the romantic and startling accomplishments of the World War.

Americans are learning that aviation adjusted to everyday needs must in time of emergency form the vital background for military-naval plans for the national defense, and the attitude of Federal, State and municipal authorities is rapidly changing from one of indifference to genuine anxiety to cooperate in the nation's aeronautic progress along sane and constructive lines. This growing national sentiment, however, in order to make itself a power to bring into being the fullest use of aerial equipment has required the co-ordinating influence of organization.

Confident that throughout the country there is a powerful demand for stable and immediate commercial progress through this newest and fastest of transportation facilities, the National Aeronautic Association has organized a complete field staff in nine districts, which are coextensive with the nine Army Corps areas of continental United States. This staff will on May 14, begin an intensive campaign everywhere to enroll members in the association with the goal set at 50,000 by June 1.

The campaign organization in each district is in charge of a chairman, whose prominence is representative of the character of both the association and of its membership. There will be chairmen for every State and subdivisions of each State, so that all communities will be canvassed to enroll those citizens who realize that if this country is to hold its own in the realm of aerial travel and transportation it has got to do it itself through the influence exerted by a cohesive body of public-spirited men and women.

Every person in step with the trend of the times knows the value of organization for awakening and informing the public mind. Strength in this great movement will come from the individual in alliance with the large body of progressive coworkers striving for the realization of America's aeronautical superiority. Thus the appeal to join the association has already brought responses from men and women in all parts of the country and the enrollment campaign is expected to result in the attainment of the 50,000 national quota —and more.

Active in the association and endorsing the membership campaign are the Hon. Melvin M. Johnson, Boston; Prof. E. P. Warner, Massachusetts Institute of Technology, Cambridge; Godfrey L. Cabot, President Aero Club of New England, Boston; Hon. James Hartness, ex-Governor of Vermont; Col. Edgar S. Gorrell, President Boston Marmon Co., Boston; Richard F. Hoyt, of Hayden, Stone & Co., New York; John D. Larkin, Jr., general manager Larkin Co., Buffalo, N. Y.; Major Loring C. Pickering, North American Newspaper Alliance, New York; Otto Praeger, former second assistant Postmaster General, New York; Arthur Woods, former Police Commissioner, New York; Col. B. F. Castle, Irving National Bank, New York; Dr. Joseph Ames, Baltimore, Md.; Rear Admiral W. F. Fullam, U. S. N., retired, Washington; W. F. Roberts, Bethlehem Steel Co., Sparrows' Point, Md.; J. S. Steinmetz, Aero Club of Pennsylvania, Philadelphia; B. H. Mulvihill, president National Gas Conservation Co., Pittsburgh; W. T. Anderson, editor "Telegraph," Macon, Ga.; Major James Meissner, Birmingham, Ala.; Charles A. Moffett, president Gulf States Steel Co., Birmingham, Ala.; Alfred W. Harris, Cleveland, O.; C. F. Kettering, chairman Ohio Aviation Commission, Dayton; Orville Wright, inventor of airplane, Dayton, O.; Glenn L. Martin, president Glenn L. Martin Co., Cleveland; B. M. Outcalt, Cincinnati; Frederick Patterson, National Cash Register Co., Dayton, O.; Howard E. Coffin, vice-president Hudson Motor Car Co., Detroit; Bion J. Arnold, chairman Chicago Air Board, Chicago, Ill.; C. Goodloe Edgar, chairman Aviation Committee, Board of Commerce, Detroit; Samuel M. Felton, President Chicago and Great Western Railway Co., Chicago; W. P. MacCracken, chairman Aviation Committee, American Bar Association, Chicago; Sidney D. Waldron, consulting automotive engineer, Detroit; Ralph W. Cram, editor "Democrat and Leader," Davenport, Iowa; Joseph Pulitzer, president Pulitzer Publishing Co., St. Louis; H. H. Bullen, American Steel & Wire Co., Denver; Dr. Frederick Terrell, banker, San Antonio, Texas; Edgar C. Tobin.

member of Lafayette Esquadrille during the war, San Antonio, Texas; Hon. Ben. W. Olcott, former governor of Oregon; Cecil B. DeMille, director-general Famous Players-Lasky Corp., Los Angeles, Calif.; Lieut. Col. W. Jefferson Davis, Los Angeles, Calif.; P. G. Johnson, president Boeing Aircraft Corp., Seattle, Wash.; Sydney S. Bibbero, Banker, San Francisco, and many others.

President Coffin also has received strong endorsement of the aims and purposes of the association in the acceptance of appointment as governors-at-large by Major Gen. Leonard Wood, governor general of the Philippines; Hon. Newton D. Baker, former Secretary of War; Gould Dietz, Omaha, Neb.; Judge William P. MacCracken, Chicago, and William F. Roberts, general manager of the Maryland plant of the Bethlehem Steel Co.

National headquarters has been established at 26 Jackson Place, Washington, with a selected staff of co-workers, and is in control of policies, information and finances. Each of the nine districts will have its own headquarters with a district manager and staff in direct contact with the general public through association chapters, flying clubs, air boards and civic associations. The basic strength of the association will be in its chapter units, chartered by the national body. The chapter is designed to organize the community interest in aeronautics so as to concentrate locally on the association's pledge to foster, encourage and advance the nation's commercial aerial welfare and maintain its independence in this new science.

The platform upon which the association stands is constructive and cooperative and pledged to the encouragement of the up-building of the aeronautic industry as an important factor in the country's economic life; to enlighten the public on the needs and operation of aircraft in business; to use its influence for the creation of a Federal agency that will control and regulate civilian air traffic; to establish airways and landing fields, and uniformity of routes, rules and customs affecting air navigation; to arrange for and assist in exhibits, contests and aerial expositions, and to cooperate with all branches of the Government in furthering the use of aircraft for the convenience and benefit of the people in peace and for national defence in time of emergency.

The membership campaign will stress the slogan of the association, "America First in the Air." The plans for the enrollment have met with the heartiest approval of the founders of the association, who are enthusiastic in predicting a success such as has never before been recorded in a peace-time patriotic movement.

Wright Aeronautical All Metal Pursuit Plane

Points of Particular Interest In The Wright All-Metal Pursuit Plane

THE Wright Aeronautical Corporation of Paterson, New Jersey, has just built, in collaboration with the Dornier Company of Rorsbach, Switzerland, a new all metal pursuit plane.

The construction in this plane is very simple, plain and rugged. All wing beams and highly stressed parts are of steel, while the covering and much of the framework is duraluminum. The framework of the fuselage is built up of a single cover of duraluminum over a series of box type girders which hold the body to its designed shape. When the pilot's seat is removed it is possible for a man to get inside and back almost to the tail. If wires need inspection or if repairs are necessary to almost any part of the shell, this is a decided advantage. Not alone is it possible to work on the inside but there is enough strength in all parts that the workman may suit his own needs as to where he will sit or move. The method of attaching the fuselage to the wing is a departure from standard practice; four bolts hold the four short struts (integral with the wing), and the fuselage together. This is done primarily for pilot's vision dead ahead. The wing is placed so that the pilot's eye comes on a center line, thus making possible vision above and below with a minimum blind angle. The four struts are not cross-braced by wires as in standard practice, there are no brace wires anywhere on the plane, each part being strong enough to stand without external bracing.

The motor bed is the only wood used on the whole plane, a mounting is constructed of box beams of duraluminum and steel where necessary. The whole is neatly cowled in with the top and sides hinged. Snap fasteners catch and hold the parts in a rigid form when in place, but the whole motor can be laid bare as easily and quickly as raising an automobile cowl.

The top part is hinged so that it rests against the wing when raised; the sides bend down and bare the motor to its mounting. It can be replaced almost as quickly as opened, and makes a neat streamline form, the lines of which conform to the fuselage.

A fuel tank, capacity of approximately two hours full speed, is conveniently located. To feed to the carburetor, air pressure is used as the tank is not high enough for gravity feed. The oil tank is on the right side and is filled by removing a small hand-hole plate. Both tanks are separated from the pilot's cockpit by a bulkhead for fire protection.

The cockpit is large, roomy, and comfortable. All controls are conveniently placed and every instrument is readily visible. A small windshield protects the pilot from the direct blast of air.

Tail surfaces are bolted rigidly to the main structure. Flipper and control wires are double to insure safety. All controls are sufficiently large and have the proper movement to give a quick and easy control. The tail skid is removable for rewrapping or such other repairs as may be necessary. It is also entirely of metal.

The landing gear is of cantilever design, which does away with the necessity of an axle. Two legs are joined inside the fuselage, in such manner that the shock absorber cord is wrapped around at the top of a forked portion, a pivoting point is just beneath. There is sufficient spring for landing on any ordinary bump, such as all fields have. The benefits derived from this type landing are that very small portion is exposed to air resistance and it is very light. The wheels are reinforced discs with tires 31" x 4", a bronze bearing which has ample surface fits over the hollow forging of the shaft and is held on by a cap. A wheel can be changed about as quickly as a wire wheel on an automobile. No attempt was made to streamline the wheels other than the disc portion, but the leg which extends from the body and holds the wheel is a very fine streamline.

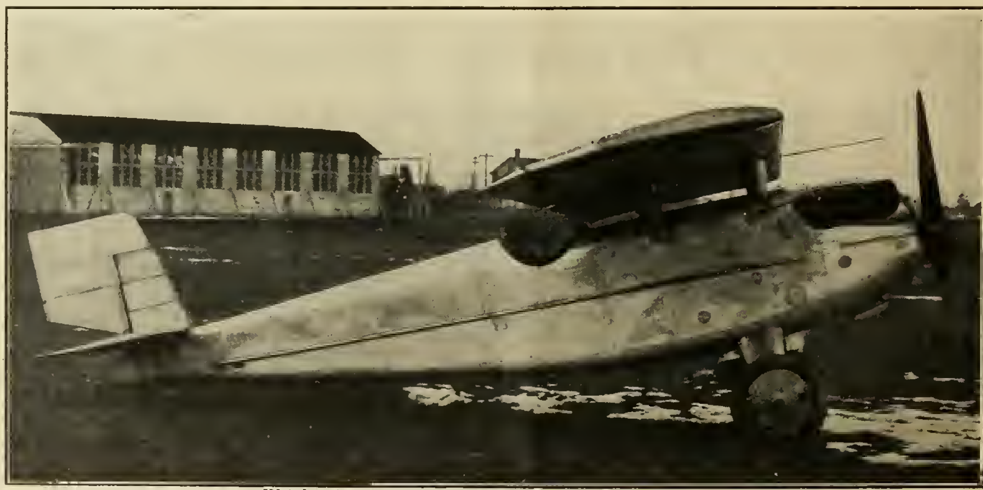
The Lamblin radiator is eliptical in form and is mounted outside the fuselage between the legs of the landing gear. It is believed that this location is the best, because none of the piping is outside and the fin portion alone is exposed to the air. A small expansion tank is of course necessary, in the line and one is mounted up near the motor through which the radiator is also filled. Another good result obtained from this location is that the pilot's vision is unobstructed by a radiator, and in case of a puncture by bullet fire would not be scalded by the hot water. A wing radiator could be used, and then more speed and climb could be expected, as on all occasions where this change was made speed increased from 10 to 12 m. p. h. more than previously.

The flexibility of this kind of construction and its main advantages are not generally realized. For instance, the Lamblin radiator might be removed without leaving a trace of installation; it could be placed elsewhere, or a wing type used. The wing covering could be removed if that were desired, without any harm to the remainder of the wing—a thing which would never make a clean job on a fabric covered wing. In case of a bad dent or holes torn in the body or wing, or by enemy fire, damage of any sort which might occur can be repaired by cutting the rivets, taking out the part ruined and a new piece fit in its place. In this same way a fuselage could be lengthened or shortened, the cockpit opening changed, or an additional one made. To reach vital and necessary parts of the fuselage hand holes are now in use. These are easily attached or removed by pressing a small spring catch. For another installation where the present doors might not fit, new one might be cut after closing up those not needed. If a square patch were riveted over the opening it would scarcely be noticed, as rivets are common to this construction.

The assembly and upkeep of this plane is quite simple because of the lack of wires, etc. A small hoist can raise the fuselage high enough to install the two forks of the landing gear. With this done and shock absorber cord in place the wheels can be slipped on. The tail skid and tail planes can go on next, with the wires connecting them to the controls. The same hoist can raise the wing up and the fuselage run under it and the four bolts tightened, as there are no wires or braces on which to make adjustments. There is little to require attention on the plane when once it is set up and has a motor installed. The service amounts to gasoline, water and oil and little else.

The metal feature in the construction of this plane is of great importance for many reasons other than upkeep and repair. It cannot be brought down by enemy gun fire nor set afire as easily as other planes. It is particularly good that in an accident which wrecks the plane there are no splinters, the metal will buckle and bend but it will not break nor catch fire. If the plane had to be landed in rough country, and it nosed over on landing it is almost sure the pilot would not be hurt. The wing is high enough above the fuselage that when upside down it would keep the fuselage from striking the ground. There is a longitudinal stiffener along the outside of the fuselage but it would not bend so as to fold at the pilot's seat for the reason that the rudder and vertical fin would strike first, thus putting tension in the top of the fuselage. There is every reason to believe that this is a very safe plane to fly. It is impossible to guess what war time developments might demand; if it became necessary to armor a part of this plane this construction lends itself to armoring very readily, which would make the plane even more immune to the dangers already referred to. This is really the first all metal plane in this country with a performance sufficient to make it a pursuit plane.

The visibility on this plane is the best that has ever yet been worked out for a pursuit machine. To look up, or to the side the pilot need but turn his head, when looking directly ahead the two vertical struts which hold the after part of the wing to the fuselage are the only obstruction. The only blind spot which can be found is up directly ahead, the wing there shuts off a very small area. This is not very important for the reason that the pilot may look over or under the wing without difficulty, besides the ship may be quickly and easily climbed, or if climbing straightened out which will take care of the one small obstruction. To the sides there are no blind angles, which has many advantages in pursuit work and also affords the vision necessary for landing in small or crowded fields. There is little occasion for an enemy ever to become hidden by the wing, the absence of a lower wing is of course what many designers have worked toward. Good angles are of the greatest importance in a pursuit plane. To go out, and not be able to see well will lose a fight—even though the plane and motor are O. K., unless the pilot can see well all the time he will be downed by one who can see. This is



Wright Aeronautical All Metal Pursuit Plane of greatest importance and presents one of the great advantages of this plane.

This plane is strong enough to stunt. With it any known maneuver can be executed without unpleasant sensation to the pilot. It follows its flight path through and is for that reason a very desirable plane to fly. All the experience gained from the war and research since are incorporated in this plane and it is to be expected that it should go where the pilot points it. All who have seen it fly, and whose opinion is based on lots of experience, agree that it is very exceptional on performance. This is of course due to the fact that the plane is light, and the H. P. sufficient. The plane can be spiralled upward, banked almost vertical, which is a severe test. This is only another form of the "climbing turn", so often spoken of, and used as the greatest necessity for a fighter. No other plane in the world today will climb higher on a turn than this one, nor will it execute a shorter turn.

On the ground and in the hangar the plane is easily handled. It can be taxied cross wind—has been done in 25 m. p. h. with 6 inches of snow on the ground. The take off is very rapid, in fact it can be taken into the air before the motor has been given full throttle. It can be steered and turned well enough so that it is always brought into the hangar under its own power.

DIMENSIONS

Wing Spread—33 feet
Cord—6 feet, 6 inches
Length over all—28 feet
Wing area—200 square feet
Powered with Wright H-3 400 horse-power engine
Air speed—160 miles per hour
Climb—10,000 feet in five minutes
Armament—2 machine guns in front of pilot
Carries two hours fuel supply

Weight empty		1819#
Pilot	180	
Fuel	440	
Ordnance	180.4	
Miscellaneous Equip.	54.7	855.1
		2674.1#

It may be noted from the above figures that the useful load is well over the specified amount required and the performance given is with the over-load.

STATEMENT OF WEIGHTS
D. W. P.

Plane light	1819	pounds
Pilot	180	
Fuel	440	
Ordnance	180.4	
Miscellaneous Equipment	54.7	
	2674.1	pounds

Ordnance carried in ballast to replace weight of following:

1 aircraft mach. gun 30 cal....	245 lbs.
1 " " " 50 "....	52. "
600 rds. ammunition 30 cal......	39. lbs.
200 " " 50 "......	50. "
2 synchronizers	11. "
1 5" ring sight	0.8 "
1 Aldis sight	3. "
	179.13 "

MISCELLANEOUS EQUIPMENT
(Part installed—part in ballast).

INSTALLED:	*lbs.*
Air speed indicator and tubing....	3.0
Altimeter	0.9
Compass	2.7
Clock	0.6
Gas pressure gauge (air)	0.4
Oil pressure gauge	0.4
Tachometer	1.1
Tachometer shaft	1.4
Water temperature meter	1.3
Oil temperature meter	1.3
Instrument board	1.0
Cushion and seat	6.0
Wind shield	0.6
3 way valve	0.3
Switch and wiring	1.0
Inclinometer	0 2
Safety Belt	2.0
Fire Extinguisher	6.5
	30.7
CARRIED IN BALLAST:	
1 oxygen apparatus	14.
	44.7

Consolidation of Government Air Laboratories

OCCASIONALLY one hears a whisper of inquiry on the possible advantages of a centralization of the experimental and testing plants of the Army, Navy and Mail air services.

A concise survey of the various experimental and research activities of the Government in aeronautics has just been made by the Aeronautical Board of the Army and Navy and forwarded to the Joint Army and Navy Board, our supreme "General Staff." The survey also presents some arguments and weighs the advantages of a competitive system.

These separate organizations are as follows. (1) The National Advisory Committee for Aeronautics. The Committee is concerned primarily with fundamental research for all branches of the Government, receives funds direct from Congress and reports to the President. Its services are available to the public as well as to the Government. In addition to Congressional appropriations, the Army has allotted $12,000 and the Navy $36,000 to the N. A. C. A. the current fiscal year to cover work in which these services are especially interested.

Fundamental research, tests and experiments in chemistry, physics and engineering are carried on by the (2) Bureau of Standards, a national institution for scientific research. Its investigations are for every branch of the Government, federal, state and municipal and for the public. Aeronautical work is only a part, covering instruments, engines, luminous paints castings and other structural materials, fabrics, dope, porcelains for spark plugs, glues and so on. The Army and Navy make allotments of their funds to cover special work at the Bureau.

(3) The Forest Products Laboratory, at Madison, Wis., handles problems respecting the properties and treatment of woods, on funds allotted by the Army and Navy, where work is done for these services.

These institutions, the Bureau of Standards and Forest Products Laboratory are concerned mainly with problems other than aeronautics and to concentrate their aeronautical work with the balance in one central laboratory, would be to duplicate in the air services' laboratory and plant certain of the personnel already in the two institutions foregoing. The ceramics division of the Bureau has experts in this subject. Their study of spark plug insulators for the air services is only a part of the routine. Likewise, the major portion of the Forest Products plant is for other uses than those of the air services.

We come then to the (4) McCook Field plant of the Army Air Service and the (5) Naval Aircraft Factory at Philadelphia. Surely something's wrong here.

The Army has its design, testing and experimental organization, with procurement facilities, at Dayton. It is admitted that it would be preferable to have the plant nearer civilization but it has been argued that the cost of removal over such a long distance would be rather too great to be borne. Besides, Dayton's citizens have raised a fund to present a nearby location and the pay roll of McCook Field is not to be sneezed at, at least, it is so claimed by one of that city's house organs. However, that's another story.

The Navy does its design work in Washington, has its Naval Aircraft Factory at Philadelphia for the execution of experimental work and the air station across the river from the Capitol for flight tests.

There are some advantages here. Design, construction and flight are in competition. Competition is the life of trade and, next to necessity, the mother of invention, or at least its mother-in-law. The same organization that designs does not do the testing, as is the case at McCook.

There is admitted duplication by the Army and Navy in engine testing, between Washington Navy Yard and McCook Field, and in other work. It is believed by the Aeronautical Board that competition in the experimenting and testing is an aid to progress in aeronautics, just as in the automobile industry. Civilian manufacturers are working with the Navy in one place and with the Army at another place, on engines, floats, planes, and so on, where the constant interchange of thought creates mental friction, heat, work.

Liaison in all these experiments and tests, between the Army and Navy, is an established fact. Each is in touch with the other and knows what is going on. This duplication is with the assent of the Aeronautical Board.

However, while certain duplication of effort is permitted and advised the Aeronautical Board, under the policy of the Joint Army and Navy Board, published in General Orders of the War Department has operated to prevent duplication along other lines.

Development of new types of aircraft or of weapons to be used from aircraft are carried on where possible by but one air service and questions relating to the development of new types of aircraft or weapons are referred to the Aeronautical Board for recommendation as to which air service will be charged with the work.

The development of rigid airships has been carried on by the Navy thus far but the Army is now suggesting that it be permitted to undertake independently the further development which will be required for functions peculiar to the Army.

In conclusion, it is not considered by the Aeronautical Board advisable to consolidate the activities of the Army and Navy at McCook, Philadelphia, Washington and Anacostia into one big union.

There are, of course, other Government agencies working in aeronautics, but not in the development of aircraft or their accessories, save in the case of the Bureau of Mines which has to do with certain work in helium and hydrogen. This activity of the Department of the Interior has built a railroad re-purification plant for hydrogen, experimented with the storage of hydrogen and helium in underground storehouses and mines, in the extraction of helium and has employed aircraft in mapping. It furnishes assistance in the investigation of fuel and pyrotechnics.

The Department of Agriculture uses airplanes in forest patrol, campaigns against boll weevil, crop estimates and the like.

Aircraft is used by the Air Mail, of course, and by the Coast Guard. The various mapping agencies of the country are interested in aerial mosaics and are using or have used aircraft, or are likely to—Bureau of Public Roads, Bureau of Soils, Forest Service, Coast and Geodetic Survey, Geological Survey, General Land Office, Indian Affairs, Reclamation Service, Hydrographic Office, Topography Branch of the Post Office, Air Service of the Army, Corps of Engineers (in civil and military activities), General Staff, Lake Survey, Mississippi River Commission, International Boundary Commission; all these have mapping activities. The Bureau of Fisheries is interested in aircraft and it is likely still other branches of the Government will be investigating possibilities.

Fokker F 5 Commercial Transport

THE latest and most advanced airplane developed in Europe for use in the air lines is the new Fokker known as type F 5. The most versatile of airplane designers has here incorporated all the experience gained during the last three years with his F 2, F 3, and F 4 types; of these the latter two are especially well known, the former for its consistent record for safety and economy on five of the main European air lines, while the F 4 type, in the hands of the United States Army Air Service made two of the greatest flights in the history of Aviation in October and November, 1922, the world's endurance record 35 hours 18 minutes and the longest non-stop cross country flight ever made, from San Diego to Indianapolis, a distance of 2060 miles. On the strength of these past performances alone a new type of Fokker commercial plane is sure to be of extraordinary interest, but it will be seen from the following description that it is an interesting development on the strength of its novel features also.


Interior F-5 Commercial Transport

In the first place it should be explained that in the course of commercial operation during the past few years the divergent requirements of each route have become more and more clear. A route like that between Koenigsberg and Moscow, a distance of approximately 750 miles over which a regular service of three round trips weekly is maintained with Fokker F 3 monoplanes and where the railroad service is almost non-existent, the obvious need is for a plane of large carrying capacity, while high speed is not of such great importance. Incidentally, this route is the longest in the world regularly flown without change of airplane or pilot.

On some of the other lines, where there is direct competition with the fast railroad service or the loads carried are largely urgent express matter and mail, high speed, even at the sacrifice of considerable load capacity and at the cost of increased landing speed, is essential.

In the Fokker F 5, one of the chief features is the possibility of quickly varying these characteristics. It is clear that this procedure will also go far towards making it possible to build commercial planes in the small quantities at present required at a more reasonable price than would be the case if a separate type of plane has to be designed to suit the requirements of service on each line.

It has been the aim of the designer to produce a fuselage which would suit every requirement and on which wing systems of various designs can be fitted while maintaining the good flying qualities for which Fokker planes are noted, whichever type of wings is used. For this the internally braced, or cantilever type of wing construction of which Fokker has for years been one of the most successful exponents, is of course particularly suitable.

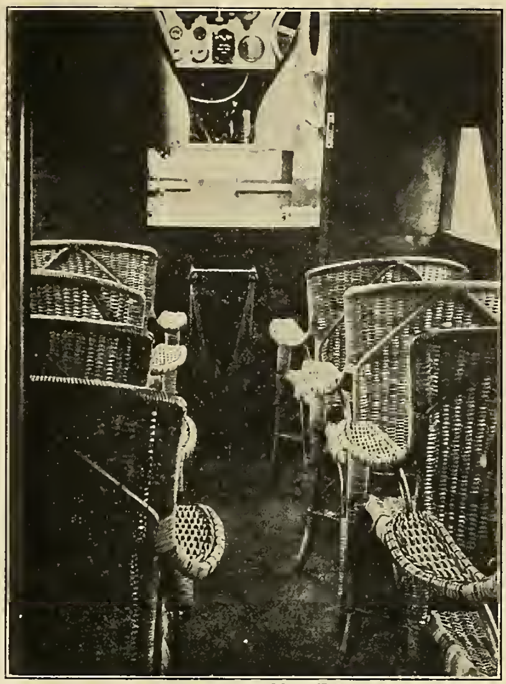
The F 5 may be flown as a biplane or a monoplane, by the simple expedient of attaching or removing the lower wings. As there is no bracing or rigging this is a simple matter. The top wing is in one piece and 49 ft. in span. Its factor of safety is so high that it will carry the weight of the machine, although with reduced load, as a monoplane or it will carry the load from two bottom wings hingedly attached to the fuselage and supported at the outer ends by N struts.

As a monoplane, the total useful load is 2000 lbs. which is equivalent to two pilots, 5½ hours gasoline at cruising speed and 770 lbs. of pay load, and the maximum speed approximately 118 miles per hour.

As a biplane, the useful load is increased to 3200 lbs., equivalent to the same amount of fuel, two pilots and 1950 lbs. pay load, and the speed is 110 miles per hour.

The above performances apply to the F 5 as fitted with a Liberty engine. The experimental machine has been flying with a Rolls Royce engine of only 340 HP, but practically any engine of approximately 350-450 HP can be fitted.

As in the previous Fokker commercial planes, the wings are built up with a very high factor of safety on box spars and covered with 3 ply veneer. In connection with this method of covering it is interesting to note that the wings of some of the F 3 machines which have been in constant use for nearly three years, were recently opened up for inspection and found to be as good as the day they were built.



Interior of Fokker F-5

A very simple nose radiator cooling system is used, which can be removed from the machine separately or in one unit with the engine by taking out 4 bolts; the radiator is circular in front view, which has made it possible to design a fuselage of very efficient shape in spite of the large cross section necessitated by the cabin.

Two pilots with full dual controls are seated behind the engine, side by side, in a very roomy cockpit, with a door between the seats through which either pilot can go down into the cabin. The engine controls and all instruments are fitted in the center of the cockpit so that they are equally accessible to both pilots. Wheel control is used for the ailerons and all controls are non magnetic.

The gasoline system consists of a double gravity tank in the wing and one feed pipe only. The shut off cocks are fitted directly to the tanks, and within reach of either pilot.

The control cables all pass outside of the fuselage where they are constantly

(*Continued on page 232*)

Side view Fokker F-5 Commercial Transport

Recent Developments in Aircraft Engines in the Navy

By Bruce G. Leighton, Lieutenant, U. S. N.

High Overhead in Naval and Military Aeronautics due to Necessity for Frequent and Costly Repairs and Replacements—High Costs Stand in Way of Commercial Industry—Navy Jumps Standard Test from 50 to 300 Hours—Engines in Flight Taxed only Half the Burden of Ground Tests—Liberty Requires 4.2 Man-hours of Overhaul for Every Flying Hour—New Navy 775 h. p. Engine to Weigh but 1.55 Lbs. H. P.—Future Engines of Larger Bore and Stroke—Anti-knock Fuel Development—Failures of the Liberty—Air-cooled Engines Have Advantages—Air-cooled Engine for Commercial Work Increase Pay Load—Radical Departures Expected in Engines Soon—Editor.

THE Army and the Navy are today the principal users of aircraft in this country and for this reason, pending the extension of aircraft into the field of general commercial transportation, it falls naturally to the lot of these two organizations to become the principal sources of information relative to material developments and operating experience in aircraft.

Development in aircraft construction and operation is limited by two considerations, first the amount of funds appropriated to the Services by the Federal Government, and second the effectiveness with which the funds appropriated are expended.

In the following paper I shall attempt to outline the development work that has been done in the particular field of power plant development, with the funds which have been appropriated specifically to the Navy. The scope of the work has been so broad and the details so manifold and varied that time does not permit more than a broad outline of the more important work which has been completed or is in hand. I shall confine myself to the engine itself, and dismiss the subject of accessories, fuel systems, cooling systems, and the like—important as they are—with the bare statement that development in these particulars has kept pace with the engines.

In classing this development work as work done "in the Navy" or "by the Navy", I refer to work done under Navy supervision and control, and paid for principally from Naval appropriations. A very great portion indeed of the details of development has been actually executed in private engineering organizations with funds which the Navy has allocated from its appropriations for the particular purpose in view. It has been the Navy's policy at all times to handle development projects wherever practicable through the medium of contracts with private engineering organizations, under conditions which assure a reasonable profit to the contractor, to the end that these private engineering organizations may be kept alive and in a healthy condition as the nucleus for the strong well organized commercial aircraft industry which is so vital to the national defense. Without the splendid ingenuity, genius, and resource which have been displayed by the various organizations which have been employed in this work, the results which have been obtained could not have been possible.

It is impracticable to name the various organizations which have been employed in this work, for obvious reasons. Suffice it to say that the Navy has called freely and fully for advice and counsel upon the magnificently organized engineering societies of the country, and upon the various government bureaus and agencies engaged in pertinent lines of work, and has at all times availed itself of the invaluable experience and resource of various private engineering and manufacturing concerns engaged in all manner of engineering work. It has everywhere met with most cordial coöperation and hearty assistance, for which acknowledgment is gratefully made.

Fundamentally, success in aircraft operation—whether it be commercial or military—is largely—one might say almost entirely—dependent upon two vital factors: first dependability and safety, and second low operating cost per ton mile if pay load carried. Safety and dependability may be had, of course, without low operating cost, but certainly low operating cost cannot be had without safety and dependability. Probably the greatest contributing factor to the present high cost of aircraft operations is the enormous overhead expense incurred by the necessity for frequent and costly repairs and replacements, and by the necessity for constant and most meticulous attention to details. The question of operating cost is perhaps of slightly less moment in military operations than in commercial operations, but just as high operating costs are today standing in the way of the establishment of the thriving commercial aircraft industry which is so vital to our national defense, so are high operating costs most seriously retarding the full realization to our Army and Navy of the tremendous inherent possibilities in aircraft as a weapon for offense and defense.

That our national defense sorely needs a strong self-supporting commercial aircraft industry, goes without saying. The question is, how to create such an industry. And the obvious answer is, let it

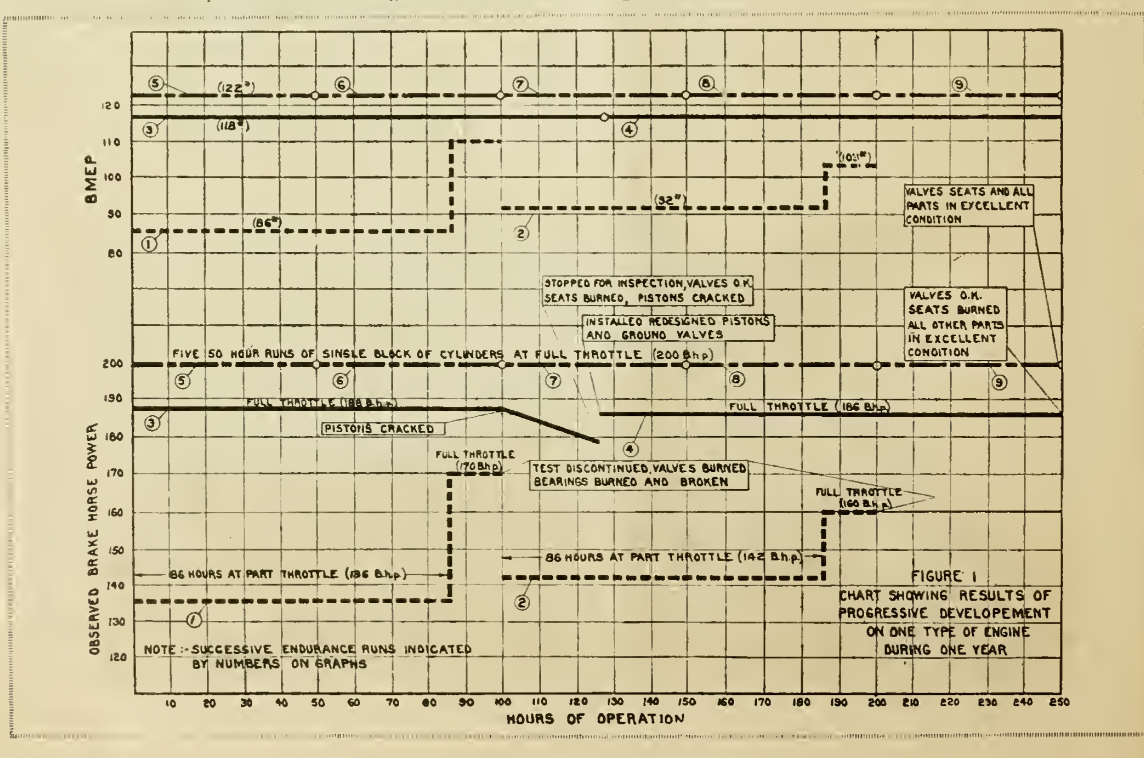


FIGURE 1
CHART SHOWING RESULTS OF PROGRESSIVE DEVELOPEMENT ON ONE TYPE OF ENGINE DURING ONE YEAR

once be fully demonstrated that aircraft are safe, that they are thoroughly dependable, and that the cost per mile per ton of pay load carried is comparable to that of other commercial carriers; let these things be clearly demonstrated and there will be no need of worrying about the creation of a commercial aircraft industry:—it will create itself.

These factors are properly the first concern of the naval and military aircraft services of our country, and it is largely in this light that we should view the development work that has been done and is still to be done. Dependability and reasonable durability must come first and always. With thorough dependability comes safety, and a material reduction in maintenance costs. Next in importance to dependability and durability comes reduction in aircraft weights, because every pound that can be saved in the structure of the aircraft results in a corresponding increase in pay load, or in speed, and a decrease in the carrying cost.

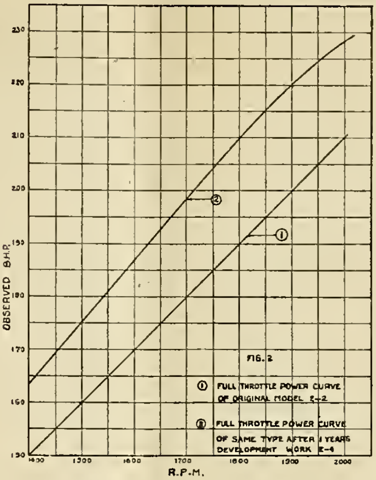
Generally speaking, an aircraft is only so good as the power plant which sustains and propels it. Advance in the performance of the aircraft as a whole can proceed little faster than advance in the performance of the power plant. The two are inseparable.

Excellence in performance is purely a comparative factor, and can be visualized only by reference to some fairly definitely fixed standard of measurement. The standard against which we have in the past measured the excellence of aircraft engines has been the so-called standard fifty-hour test which, stated briefly, requires little more than that an engine shall complete ten five-hour runs at between 90 and 100% of its rated output without failure in any "major" part, and without "persistent"—mark the word—"persistent" failure in minor parts.

Practically all types of engines in common use today have satisfactorily met the requirements of our fifty-hour test standard, and yet it is a fact that failures of engines and engine accessories have been responsible for more uncompleted flights, forced landings, and accidents than all other causes combined. The requirements of the accepted test specifications have been met, but apparently the requirements of actual flight service have *not* been met. It follows, then, that the 50-hour test as a standard of acceptance must be inadequate. Safety, dependability, economy, all demand something far better.

Something over a year ago, the Bureau of Aeronautics, of the Navy Department, set up tentatively as a mark to shoot at, a new standard of service acceptability, a test which aimed at demonstrating the entire capability of engines to give continuing dependable service without necessity for overhaul or other than minor repairs or adjustments for at least as long a period as one might reasonably expect the structure of an airplane to stand up without a thorough going over in normal flight service. The test as originally outlined required three one hundred hour periods of continuous running. Each one hundred hour period comprised 86 hours at an output corresponding to normal cruising power at 2,500 feet altitude, and 14 hours at wide-open throttle at sea level, to simulate conditions which obtain in take-off and initial climb. This was a long step ahead of the old standard fifty-hour test requirement, and it must be confessed that when we first set up the new standard we were actuated a great deal more by a determined hope than by confident expectancy.

A year's intensive work on a number of types of engines has fully convinced us, however, that this measure of excellence is quite capable of being fully realized in all classes of engines, without in any way increasing the weight, and we have recently raised the standard to 300 hours of continuous wide-open throttle running at sea level.



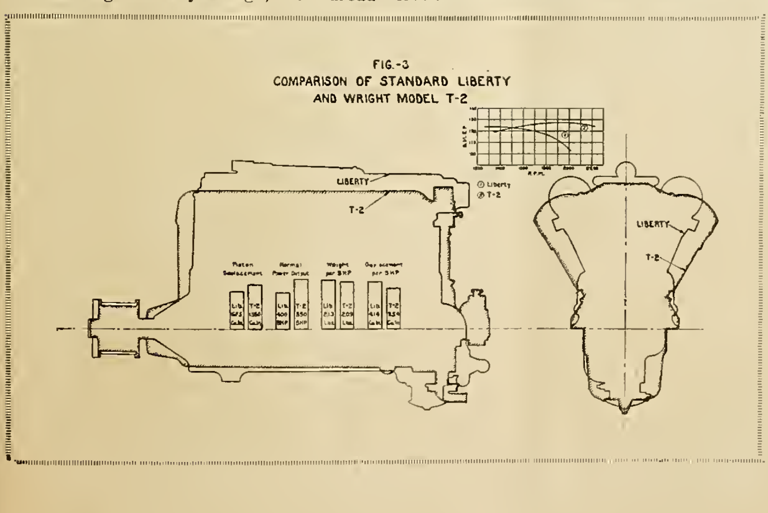


FIG.-3
COMPARISON OF STANDARD LIBERTY AND WRIGHT MODEL T-2

It should be fully realized that wide-open throttle running at sea level taxes an engine far more than does the kind of running which it gets in the hands of an experienced pilot in normal flight service. Actual comparison made between conditions noted in identical engines after full throttle, sea level running, and after normal flight operation, indicate clearly that the life of an engine in normal flying service is at least double the life of the same engine under full throttle, sea level running. On this basis, which our experience indicates to be entirely safe, a 300-hour wide-open throttle test at sea level is the equivalent of at least 600 hours of operation in normal flying service. At an average cruising speed of 75 miles per hour, this represents some 45,000 miles of cruising. Few airplanes have yet been built whose structures will stand up for this amount of cruising without very complete and extensive overhaul, if at all. I mention these things to indicate that the goal we are aiming at is far above the present general measure of acceptability.

As an example of the type of work that has been done, I shall cite several specific instances.

An engine of the model which is being installed in our first rigid airship—the Packard 1A—1551—has already completed 300 hours of practically continuous running developing the maximum output which it will be called upon to develop in flight service. No repairs or refitting of parts were made throughout the entire test and at the end of test careful inspection proved the engine to be still in excellent running condition and in need of no repairs or adjustments. As an indication of the excellent valve conditions which obtained, the average fuel consumption of this engine for the whole 300 hours of running was slightly less than .44 lbs. per B. H. P. per hour. In fairness to other models of aircraft engines, it should be pointed out that this engine was especially designed for airship service and is very much heavier than engines used in other classes of service.

In the lighter types of engines, more particularly adaptable to H/A service, we have completed a 300-hour test in three one hundred hour periods with one type—the Aeromarine U-8-D—an eight-cylinder Vee water-cooled engine. During this test the engine was run at part throttle at 1800 r.p.m. developing an output equal to normal cruising power at 2,500 feet altitude for a total of 258 hours, and at wide-open throttle at sea level for 42 hours. At the end of the 292nd hour of the test, a break occurred in the crankshaft which required the installation of a new shaft to complete the run. This break was serious, of course, but of such a nature that the cause was quite evident and the remedy comparatively simple. Aside from this failure, and slight retouching of part of the intake valves at the end of the first 100 hours, no adjustments or repairs were made to the engine throughout the test. At the end of the test the power output of the engine was slightly greater than at the beginning, the valves and seats, the bearings, gears, —in fact, all parts—were in excellent condition and in need of no repairs or refitting. This was an extremely gratifying performance from the standpoint of durability and a distinct encouragement, but the engine as tested compared unfavorably in weight per horsepower and in installation dimensions with another engine of approximately the same power which had been in wide service use.

For specific example of the importance of weight reductions see Appendix 1.

We accordingly set about having changes made in the design not only materially to decrease its weight, but at the same time materially to increase its output, keeping still the same excellent durability characteristics. The redesign (designated the U-873) was completed and subjected to preliminary tests at the increased output. Certain difficulties were met with which entailed slight further redesign in certain parts to maintain the all around durability characteristics desired. The engine is now finally completed, has satisfactorily undergone its preliminary trials, and is about to be subjected to its final endurance test, comprising 300 hours of continuous full power running. All indications are that this test will be satisfactorily completed.

The original model of this engine, the U-8-D, weighed 575 lbs. and developed 225 B.H.P. at 1800 r.p.m. The modified engine now under test—the U-873—weighs 520 lbs. and develops B. H. P. at 1800 r.p.m.

Another, and materially lighter model, the Wright Model E-2, having approximately the same general characteristics as the U-8-D was submitted to the same test. This model, a development of the small Hispano-Suiza, has been used extensively in our service for advanced training airplanes with very good results by comparison with other engines previously in general use. Our records show that its flying life between overhauls averages 101 hours, as against 72 hours for the Liberty engine. It had repeatedly been subjected to standard fifty-hour tests, and was thought to be an exceptionally durable type, but when we got into long duration testing unexpected shortcomings were uncovered, principally in the connecting rod bearings, valves, and valve seats, all of which went bad before the first hundred hours had been completed. The subsequent development work on this engine is particularly interesting because the results obtained have so completely justified our adoption of the 300-hour test standard in place of the old 50-hour standard.

Figures 1 and 2 show the progress that has been made. Referring to Figure 1, graph (1), is a graph of the first attempt at a 300-hour run. Note that in the 14 hours full throttle running at the end of the period the power output was considerably below the normal rated power of this model, 180 B.H.P. at 1800 r.p.m. This condition was brought about by the poor valve conditions. After this run new connecting rod bearings and valves of the original design were fitted, valve seats reamed out and valves readjusted, and a second attempt was made as a check on the first, with the result shown in graph (2). After some investigation and experimentation, new valves and bearings were developed, and were fitted in a new engine of the same model. This engine was then set up and subjected to a practically nonstop run of 125 hours at wide-open throttle as shown in graph (3). Examination at the end of this test showed no evidence of bearing failure, that the valve burning had been corrected completely, but that the valve seats were seriously eroded. The valves were reseated and adjusted, new pistons of modified design installed. No other parts were repaired, replaced, or refitted. This same engine was then submitted to a second continuous run of 125 hours at wide-open throttle as shown in graph (4). At the end of this run the modified pistons were in excellent condition. Valve seats were again found to be badly eroded, but valves were still in excellent condition. Careful inspection disclosed no evidences of deterioration or serious wear in other parts. Further testing of this engine was discontinued and the engine was laid aside until means could be found to overcome the valve seat difficulties. An entirely new design of cylinder block was laid out and one block built for test. At the same time changes were made in cam contour to better the volumetric efficiency and increase the output. A single block of this new design has recently been subjected to five consecutive fifty-hour non-stop runs at full throttle. Graphs (5) to (9) inclusive indicate the results of these runs. In preparing these latter graphs the output of the single block has been doubled to represent the output which is to be expected from the complete engine. During this 250 hours of wide-open running, there has been no evidence of valve trouble, the valves have not been ground nor adjustment made, and both the valves and seats appear to be in practically as good condition as when originally installed. Two of these new cylinder blocks, with the modified cams, have been substituted for the old style blocks on the same engine that completed the previous 250-hour test and this engine is now being set up for further endurance running at wide-open throttle. Aside from the new cylinder blocks and cams, this engine is in exactly the same condition as at the end of the previous 250-hour test, no adjustments, repairs, or replacements in other parts have been made. All of the changes mentioned above are being incorporated in new engines under construction, which are known as Model E-4. In Figure 2 is shown a power curve of the original E-2 and of the modified engine as determined by actual test of assembled engines.

While a full three hundred hour test at continuous wide-open throttle has not yet been completed with this engine, the running which *has* been done justifies the prediction that this engine as modified is quite capable of withstanding such a test.

Work of a similar nature to that outlined above has been in progress in all classes of engines for all types of service, and with very similar results. Invariably, the efforts that have been made have resulted in a marked increase in durability, and practically without exception changes in design have at the same time resulted either in a decrease in weight, an increase in output, or both. Much remains to be done, of course, but lessons learned from development work in one type are usually more or less applicable to all types, and from the tests which have been completed thus far, and from those which are now in course, we have become fully convinced that it is a question of only a short time until we shall have a complete line of engines for all types of service operations ranging from 60 to 700 H.P., some air-cooled, others water-cooled, which will be capable of withstanding at least 300 hours of continuous full throttle running without failure in any part.

The costs involved in overhauling aircraft engines are not generally appreciated. The records of our service show that the standard Liberty engine, a 50-hour test product, requires complete overhaul every 72 hours of flying operation. Averages show that it requires approximately 300 man hours of direct labor at each overhaul to remove a Liberty engine from a plane,

FIG. 4
COMPARISON OF STANDARD LIBERTY AND CURTISS D-12

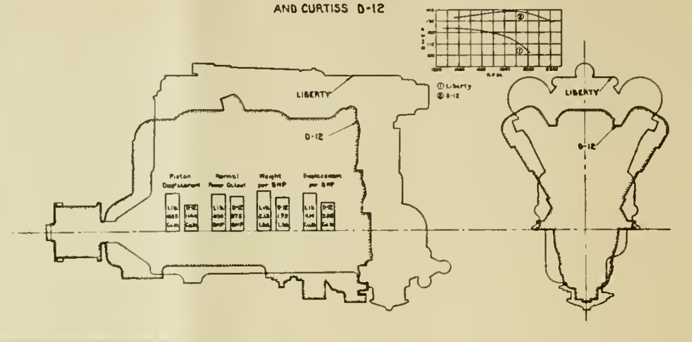
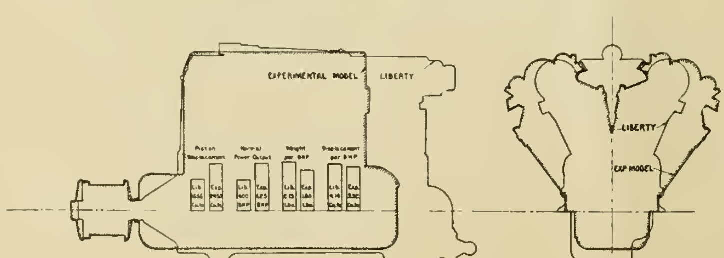


FIG. 5
COMPARISON OF STANDARD LIBERTY AND EXPERIMENTAL MODEL NOW BEING CONSTRUCTED



disassemble, clean, repair, and refit, reassemble, test, and reinstall in the plane. This does not include supervision, or transportation to and from the shop. In other words, for every hour that the engine flies, 4.2 man hours of direct labor must be paid for, within the walls of the overhaul shop. Skilled labor is required for this work. I believe that $1.50 per man hour is a very conservative figure for the cost of such labor plus overhead, which gives a cost in overhaul labor alone of $6.30 per flying hour of the engine. At a cruising speed of 75 miles per hour, this represents an overhaul labor cost of 8.4 cents per mile for a single Liberty engine plane. It does not include the cost of replacement parts required in connection with overhaul. These oftentimes reach a value up to 25% of the total cost of a new engine. It does not include the cost of the operating and field maintenance crews and equipment. The overhaul cost of operating an engine is inversely proportional to the durability of the engine. As I have previously indicated, the three hundred hour wide-open throttle test which we are now coming to adopt as standard is probably the equivalent of not less than 600 hours of normal flying operation. It requires only a little elementary arithmetic for one to appreciate the importance of this work.

The work which has been done has most forcibly demonstrated two extremely important things, first that we may confidently predict for the immediate future a degree of dependability and durability in aircraft engines, which will at least equal that of the aircraft structure itself, which means that frequent removal of engines from aircraft for overhaul is not necessary and that the quantity of spare engines and replacement parts can be enormously reduced, and second that to realize this degree of dependability it is not necessary that the weight per horsepower developed be at all increased over the weights which are present in ordinary engines of today.

Reduction in Weights

Contrary to a rather widely accepted belief, the features that result in the greater decreases in weight are at the same time features which inherently tend to increase rather than decrease the factors of safety in vital engine parts. To use a familiar example, a 12-cylinder Vee type engine can inherently be made more durable than a twelve-cylinder "in-line" engine of the same weight and power for the reason that the backbone of the engine—the crankcase and crankshaft—are, due to their shorter lengths, enormously stiffer. Long crankshafts and cases are inherently heavy, flexible, and weak; short crankshafts and cases are inherently light, stiff, and rugged. Multiplicity of parts is within reasonable limits an enemy to ruggedness and dependability, and in a large measure at least is incompatible with light weight. Within limits, it requires less weight of metal to enclose a given cylinder volume in a few cylinders of large bore than in a large number of cylinders of small bore. After all, and again within limits, it is the total piston displacement that largely determines the limiting possible output of an engine, not the number of cylinders. The more recent engine designs which have been developed for our service have all been drawn up with these principles in view. Figures 3, 4, and 5 illustrate the results of this trend in design. Figure 3 is an engine recently developed—the

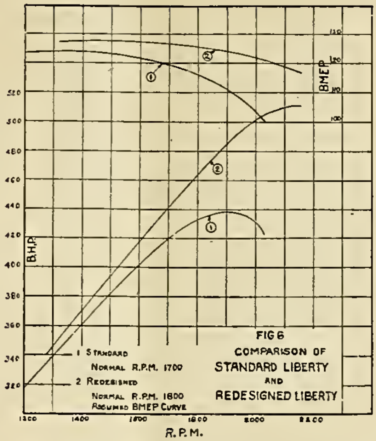


FIG 6
COMPARISON OF STANDARD LIBERTY AND REDESIGNED LIBERTY

Wright Model T-2*—which has 1950 cubic inches piston displacement, and a normal output of 550 B.H.P. It weighs 1150 lbs. No weight has been spared in the design of the stressed parts. As a matter of fact, its weight per cu. in. of piston displacement is considerably greater than is the Liberty engine for this reason. But it has on test fully demonstrated its ability to stand up to a 550 H. P. output immeasurably better than the standard Liberty stands up to a 400 H. P. output, and the weight per effective H. P. output has consequently not been increased.

Figure 4 is an outline of a smaller 12-cylinder engine—the Curtiss Model D-12* —especially adaptable to pursuit work, which has been perfected, during the past year, and which is now being used rather widely in newer types of aircraft. This engine has a total piston displacement of 1145 cu. in., weighs 670 lbs., and develops 375 B. H. P. at 1800 r.p.m. An engine of this type has recently completed a 100-hour endurance test without failures or serious deterioration in any parts, and is now being subjected to further testing at full throttle. Previous to the 100-hour test, this same engine had completed something over 100 hours of preliminary test running during which certain minor changes in design were incorporated. So far as the highly stressed parts are concerned, however, no evidences of weaknesses have been uncovered in more than 200 hours of test running at or above three quarters power.

Figure 5 is an outline of another experimental type now under construction. This engine is barely out of the design state at present and for this reason I should hesitate to mention it were it not that it illustrates so well the possibilities in reduction of weight per unit of power through economy in crankcase and crankshaft lengths, rather than by reduction of sections in stressed parts. By an ingenious and somewhat unusual cylinder arrangement and construction, it has been possible to obtain a total piston displacement of 2450 cu. in. in the extremely small overall dimensions shown. The weight will be 1150 lbs. It has been designed for an assumed output of 775 H. P. at 1800 r.p.m. but for the purposes of preliminary trials will be rated at 625 H. P. at 1650 r.p.m. Its weight per rated horsepower will be 1.8 lbs. On the designed 775 H. P. basis its weight per H. P. will be 1.55 lbs.

This engine is not yet completed and hence no test data can be given, but by virtue of the extreme compactness of the design and by careful study of stress distribution it has been possible to provide unusually high factors of safety in all the highly stressed parts and still keep the overall weights extremely low. By virtue of these high factors of safety, the dependability and durability should be very excellent indeed.

Other new experimental models which promise comparable weights per horsepower with excellent durability characteristics are now under construction and are expected to be ready for running tests in the near future.

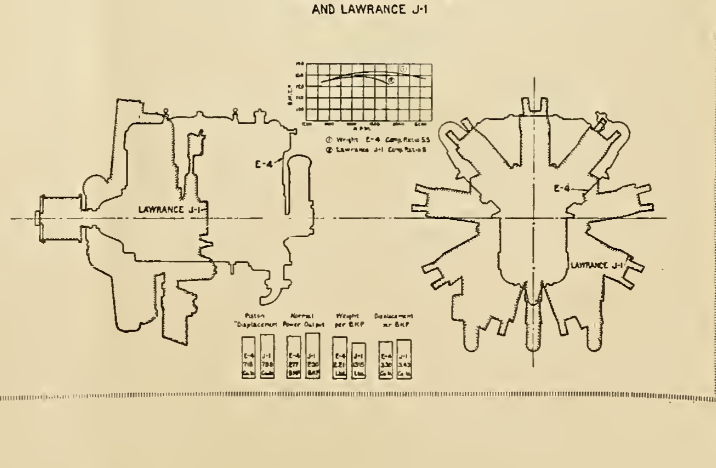
The practicability of using much larger cylinder bores than are commonly used in aircraft engines has been under most careful investigation. A six-cylinder vertical "in line" engine has been built and recently tested, which has cylinders 7" bore and 8" stroke.*

*A complete description of this engine has already been published, see Automotive Industries, Vol. 47, No. 2, July 13, 1922.

*A complete description of this engine has already been published in Aviation, Vol. 13, No. 16, October 16, 1922.

*A complete description of this engine, the Wright Model D-1, has already been published. See Automotive Industries Vol. 46, No. 16, April 20, 1922.

FIG-7
COMPARISON OF WRIGHT E-4 AND LAWRANCE J-1



This engine was especially designed for dirigible service which requires certain attributes not conducive to extremely light weights, and weight considerations were subordinated somewhat to these considerations. In the preliminary tests of this engine, much valuable information relative to the performance of larger bore cylinders has been gained. Special high performance runs of a test cylinder have been conducted at a compression ratio of 6.5 to 1, developing a B. M. E. P. of well above 140 lbs. per square inch at 1400 r. p. m. No trouble has been experienced in cooling the pistons or cylinders either in the test cylinder or in the complete engine. The tests thus far conducted with the complete engine have demonstrated the entire suitability of the design for dirigible service. Further tests are in course and projected to study the possibilities in the use of cylinders of this or even larger sizes in the construction of larger power units for heavier than aircraft service.

In this connection, with the use of large bore cylinders the question of inertia forces is a very serious problem. To offset this difficulty, the use of duralumin connecting rods and of magnesium pistons has been under serious consideration. Rods and pistons of these materials are being procured for exhaustive block and service tests in Liberty engines with a view to adopting similar practice in all types of engines.

In all more recent designs, the possibilities of increasing rotative speeds and B. M. E. P.'s have been constantly in mind and newer designs have been laid out accordingly. That the factors of safety provided are adequate to withstand over-loading has been well demonstrated in special high power running of more recent designs. The engine shown in Figure 3 has been run for hours continuously at 20% overload without failure in any part. The engine shown in Figure 4 has been repeatedly flown in racing service at an output of 450 B. H. P. at 2300 r. p. m. without evidence of failure.

The question of realizing higher specific power and lower specific fuel consumption through the use of high compression ratios has been thoroughly investigated. We are indebted to the Bureau of Standards for much valuable research in this line, not the least of which has been a study in collaboration with the Bureau of Mines, of the sources of supply for various anti-knock fuels in the country. Much of the work which has been done in this connection by the Bureau of Standards has already been presented in a paper read by Mr. S. W. Sparrow.* As the result of this work coupled with a considerable amount of corroborative block and flight testing which we have done with various service types of engines, we have become thoroughly convinced of the entire practicability of using in general service considerably higher compression ratios than we are now using. The chief problem to be solved is, of course, the procurement of a fuel which will not only eliminate detonation without interfering with proper engine operation in cold weather,* and without attacking the materials of the engines, but which will also be readily available for general distribution in large quantities at a reasonable cost. Anhydrous alcohol appears to fulfill the requirements quite satisfactorily, and we are now, after extensive preliminary investigation, proceeding with final service tests by conducting all flight operations at three of our air stations, with a blend containing 30 parts alcohol and 70 parts gasoline.

The use of higher engine speeds for increasing the output without increase in weights is very attractive but is only of real advantage if light weight and thoroughly dependable reduction gears are available. This is one of the most difficult problems which we have had to face. It is a relatively simple matter to make durable gears, but far from simple to make *light* durable gears which will stand up as long as the rest of the power plant. This problem appears now, after more than four years of continuous study and experiment, to have been pretty well solved. One very important development has been the interposing between the crankshaft and the gears spring couplings which iron out the torsional vibrations and relieve the gear teeth of the immense fatigue stresses imposed with the ordinary rigid connections. We are now proceeding, with confidence, to the construction of dependable and durable gears, which have an overall weight of .25 lb. per H. P. absorbed, or less.

The Liberty engine, owing to the fact that so many engines of this type are already on hand, deserves more than passing attention. It has been apparent for some time past that the Standard Liberty Engine has rapidly been falling behind the procession. It has neither the durability, the dependability, nor the weight factor to compete successfully with more modern types. Its life in normal service, as I have mentioned before, is but 72 hours between overhauls, it requires constant and most meticulous attention at all times. Forced landings due to all manner of minor failures, and occasionally due to major failures, are relatively frequent and not infrequently result in complete loss of aircraft. We can ill afford to predicate our national defense upon aircraft equipped with this engine, when such aircraft must be called upon to meet on equal terms aircraft equipped with more modern types. Yet we can ill afford to discard the large supply of these engines which still remains in store, bought and paid for, and purchase from present appropriations new engines to replace them.

A careful study of the failures which occur in Liberty engines in service indicates that the weakness of the engine lies primarily in its lack of rigidity, in the manifolding, and in the valve actuating mechanism. Probably the most annoying source of trouble lies in the frequent occurrence of water jacket leakages in flight. This trouble cannot, apparently, be corrected short of complete redesign of cylinders. This is at present being done, experimentally. To kill three birds with one stone, the redesign of cylinders has taken the form of a six-cylinder aluminum cylinder block, with complete new cam actuating mechanism and intake manifolding which follow very closely the cylinder, valve, and manifolding design of more modern types. The use of the block construction enormously stiffens the engine and should, in a large measure at least, eliminate the troubles which have resulted from this lack of rigidity. At the same time the jacket failures are eliminated, while new valve mechanism and manifolds result in a materially improved volumetric efficiency. Other minor modifications have already been made, or are being made, in standard engines in service to correct timing gear breakages, generator failures, connecting rod bearing difficulties, piston burning, and the like.

The first experimentally modified engine is practically completed and trials will be begun in the near future. It is too early as yet to predict with assurance its entire suitability for service use, but the fact that the new parts installed incorporate practically identical features to those now in common use with superior results in more recent models, should assure a very marked improvement indeed.

In Figure 7 are given two graphs showing first the present power output of the standard Liberty engine, and second the predicted performance of the modified engine, based upon actual test results obtained with similar cylinder, valve, and manifold construction in other types of engines. Particular attention is drawn to the relatively low B. M. E. P. values realized in the standard Liberty, and especially to the sharp break in the B. M. E. P. curve at about 1650 r. p. m. It is this characteristic as much as the frequent cylinder jacket failures which has led us to complete redesign of the upper works of the engine.

In this modification we have cut deep, it must be admitted, but after most careful study and continuous testing of a number of alternative courses which suggested themselves, we have become convinced that there is no other course. We have been greatly restricted in this work by the fact that modified parts must always be applicable to the standard Liberty crankcase, shaft, connecting rods, pistons, and accessories. There is no doubt that the power output shown in Figure 6 will be realized nor is there any doubt that the engine as modified will be measurably more durable and dependable than the standard Liberty. The only question is, how *much* more dependable and durable it will be. This is a question that can be answered only by actual running tests which are about to be begun.

The Air-Cooled vs. the Water-Cooled Engine

I have been rather hesitant about entering such controversial ground as a discussion of the relative merits of the air-cooled and the water-cooled engine, but the work that we have been doing during the past two years has brought so much definite information to light that the subject cannot well be passed over.

If we assume equal durability, flexibility, and fuel economy, I believe that every one must agree that the air-cooled engine must have a distinct advantage over the water-cooled engine for aircraft service, owing to the elimination of the weight and complications imposed by radiators, water, and piping. The chief contention between the air-cooled and the water-cooled proponents appears to be one of whether the air-cooled engine can be made to equal the water-cooled engine in these three characteristics. It has also been contended by the water-cooled proponents that the air-cooled engine must, due to its relatively large frontal area, have a much higher head resistance factor than has the water-cooled engine. These questions have been largely based on surmise. Little really definite comparative information has been at hand, for the simple reason that until very recently there have been no air-cooled engines of any

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*Testing Fuels for High-Compression Engines, by Stephen M. Lee and Stanwood W. Sparrow. See S. A. E. Journal, Vol. 12, No. 1.

*For example, benzol has a tendency to solidify at cold temperatures.

considerable output available in this country for actual comparative flight tests.

Something over two years ago, we began in real earnest an intensive development and testing program to determine definite answers to these questions. The first requirement was of course to get, for flight service, an air-cooled engine which would have an output comparable to more commonly used water-cooled engines. Five engines of an exceptional type—the Lawrance Model J—a convenient nine-cylinder radial—having a rated output of 200 H. P. at 1800 r. p. m. were contracted for, for development purposes.

The first of these engines was completed about eighteen months ago, was placed on a test stand, and test running begun, mostly at wide-open throttle. I won't burden you with the details of these tests. The thermal characteristics of the engines as originally designed proved to be entirely sound and to require no modification. A number of mechanical troubles developed, however, as tests continued, involving changes in crankcase design, crankshaft and main bearing design, cylinder securing, valve springs, cams, accessory drives, propeller hub, and all manner of minor details. Parallel with these block tests, sample engines have been in actual flight service for a period of nearly a year. The same engine has been flown in weather ranging from the hottest days of summer to the coldest days yet encountered this winter (16° F.); from sea level to 20,000 feet; in dry weather and rain; in parallel service with the best water-cooled engines of comparable power which we know of today. Troubles have been encountered to be sure, *many* troubles, but they have almost invariably been troubles of a mechanical nature, and without exception means have been found for overcoming them. Not one instance of trouble of any nature has been found which has been at all inherent in the fact that the engine was air-cooled rather than water-cooled. We have found no indication in any of our tests during more than two years of constant running of engines of this type that the air-cooled engine as such is less efficient, less flexible, less powerful, less dependable, less durable, or more sensitive to changes in altitude or in temperature, than is the water-cooled engine. It is certainly lighter than the water-cooled engine with its radiator, it requires less preliminary running to warm up in cold weather, less attention on the part of the pilot in flight, and its installation is distinctly simpler and cheaper.

To gain an indication of the relative aerodynamic features of the air-cooled and water-cooled types, we have built for comparative flight tests three types of airplanes which are exactly alike in all respects except for the power plant installations. One of these types has the air-cooled engine installed, the other two types have two different models of water-cooled engines. Two of these airplanes, one equipped with the Wright Model E-2 water-cooled engine and the other with the Lawrance Model J-1 air-cooled engine, were entered in the Detroit races this year. Unfortunately, the water-cooled type did not finish due to a broken propeller tip which forced her out of the race. But from comparative flight trials prior to the race and from recorded times for the early laps of the race, it is pretty conclusively established that the two machines, using identical propellers turning at the same r. p. m. were exactly equal in speed.

The power output of the E-2 engine was brought up to that of the J-1 engine by installing in the E-2 special high lift cams and special pistons to give a compression ratio of 6.5 to 1. The J-1 engine was in all respects standard.

I regret that our testing program in this regard is not yet completed, and that complete quantitative data are not, therefore, yet available. All information as yet available, however, appears to confirm the results noted during the Detroit races.

The wide investigation that we have pursued during these past two years appears to have established beyond the range of surmise the following characteristics for the air-cooled engine of smaller powers up to, say, 300 H. P., as compared with the best existing types of water-cooled engines of comparable power.

(a) There is nothing inherent in the air-cooled engine that renders it less durable or dependable as a mechanism than is the water-cooled engine.

(b) As regards thermal characteristics, the air-cooled engine is at least the equal of the water-cooled engine. Block and flight tests over a period of many months have demonstrated a specific power and specific fuel consumption which is the equal of the best water-cooled engines of comparable power which we know of.

(c) The air-cooled engine is not unduly sensitive to wide changes in atmospheric temperature in flight service.

(d) The head resistance of the radical air-cooled engine of the largest size that we have had in flight, 43-in. diameter overall, is not greater than that of the water-cooled engine of the same power plus the necessary radiator.

(e) The air-cooled engine is much more quickly warmed up and made ready for flight in cold weather than is the water-cooled engine, and will withstand long glides and dives at high altitudes without interfering with its operation.

(f) The air-cooled engine requires less attention on the part of the pilot than does the water-cooled engine.

(g) The weight of the air-cooled engine is unquestionably inherently smaller than that of the best water-cooled engines with its radiator and water. In this connection, I have prepared Figure 6 to show at a glance a comparison between the dimensions and general characteristics of two actual types now in general use in our service, the Lawrance Model J-1, air-cooled, and the Wright Model E-4, water-cooled. The data shown in this figure represent actual test data for the most recent models of each type. Weight data for each type are based upon *dry* engine. The water and radiator of the water-cooled engine is not included. This represents an additional handicap in favor of the air-cooled type of approximately 6 lbs. per H. P.

The conclusions to be drawn from these facts—and they now are fully demonstrated facts, not surmise—are perfectly obvious.

What are the possibilities in air-cooled engines of larger powers, remains to be determined. The Engineering Division of the Army Air Service has in its excellent research at McCook Field demonstrated the entire practicability of construction air-cooled cylinders of large displacement which have thermo-dynamic characteristics equal to the best water-cooled construction. It remains only to solve the relatively simple mechanical details of combining such cylinders into a larger power engine without exceeding reasonable frontal dimensions. How large diameters are practicable before the head resistance factor of the conventional radial engine becomes an off-set to the other inherent advantages of the air-cooled type is a question that can be decided only by actual flight trials which must naturally wait upon the development of larger air-cooled engines which are now being projected. The question of frontal dimensions is largely a question of mechanical arrangement. We are now investigating valve arrangements which will permit very material reduction in radial engine diameters through the elimination of the top hamper now used in conventional overhead poppet valve cylinder designs. A highly experimental engine is under construction which entirely eliminates the overhead valve gear, there being nothing at all above the cooling fins of the cylinder head proper. It is too early to predict the outcome of this project, but the advantages to be gained not only in the way of head resistance, but in overall weight as well, are self-evident.

The air-cooled engine, at any rate in the smaller sizes, has definitely arrived, and is in our service definitely displacing the water-cooled engine in all sizes up to 300 H. P. No new types of water-cooled engines in these powers are contemplated.

What the future is for air-cooled engines of larger powers we are not yet prepared to say definitely, but the prediction is ventured that just as the air-cooled engine is now displacing the water-cooled types in the smaller powers, so will it extend its field progressively to the larger powers and displace the water-cooled engines in this field.

I have outlined only the more important work that we have been doing along more or less conventional lines—namely in the four-stroke Otto cycle reciprocating engine. These are the things of the present and the immediate future. That we have not confined ourselves to convention alone, you may be sure. Many other lines have been or are being investigated. I have refrained from mentioning investigations that we have been making along other lines, for example, in high speed solid injection auto-ignition engines, in two-strokes cycle engines, and others, because all of this work is still in its preliminary stages and is still too full of conjecture to warrant definite predictions for results as applied to actual aircraft use. It is not to be doubted that radical departures from present conventional practices will, soon or late, gradually or suddenly, find their way into the aviation field, but as yet no new departure has presented itself which appears to give promise in the immediate future of displacing the present more conventional practices in common use. Our chief hope for betterment, so far as the present is concerned at least, lies in perfecting the kind of apparatus that we have been accustomed to using. And in looking back over the results of the recent development work that has been done with the funds which have been made available to us, we feel that the funds have on the whole been spent to good advantage, that safety, dependability, and operating cost of aircraft have been very materially improved, and that the strong commercial aircraft industry which the national defense so sorely needs is thereby much closer to realization than it has ever been before.

APPENDIX I.

The Influence of Power Plant Weight on Transportation Costs

One often hears the statement that the requirements for Commercial Aviation are quite different from those for military aviation, that for Commercial Aviation one can afford to use considerably heavier engine types than are at present in common use for military aircraft. A rather careful study of the influence of power plant weight on the amount of pay load that may be carried throws some interesting light on this subject.

I have taken a basis for comparison the performance of a type of aircraft which has recently been developed, and which has an unusually high carrying load per H. P. by comparison with existing types of aircraft.

The total gross weight of the machine as built is 7175 lbs. The engine used is a Standard Liberty developing 400 B. H. P., which gives a power loading of 17.9 lbs. per B. H. P., a very satisfactory figure.

With a cruising radius of 500 miles this plane as built can carry a pay load of 1010 lbs.

The power plant weights are as follows:

Dry weight of Liberty engine	872 lbs.
Engine accessories	58
Starting system (hand starter)	17
Propeller	58
Cooling System (dry)	132
Cooling water	113
Oil System (dry)	33
Fuel System (dry)	184
Engine controls	15
Total power plant weight, (excluding fuel)	1462 lbs.

As a basis of comparison, I have taken a purely hypothetical assumption that there is available to replace the Standard Liberty engine, an air-cooled engine which will deliver 400 H. P. and which will weigh 600 lbs. dry. I believe that such an engine is quite capable of being manufactured.

With such an engine it is reasonable to assume a power plant weight of:

Engine	600 lbs.
Engine accessories	33
Starting system	17
Cooling system	0
Water	0
Oil system (dry)	33
Propeller	58
Fuel system (dry)	184
Engine controls	15
Total power plant weight	940 lbs.

(excluding fuel which is assumed to be the same for both cases.)

Owing to the simpler engine mounting required for the air-cooled engine, there will be an additional saving in weight which is conservatively estimated at approximately 50 lbs.

The total saving in power plant weight in the case of the latter installation is therefore—

1426—940+50=572 lbs.

This saving in dead weight of the power plant permits an increase of 572 lbs. in the pay load, without in any way affecting the performance characteristics of the plane.

Assume that a commercial transportation company has a regular contract to carry 3000 lbs. of goods per day, a distance of 500 miles.

To fulfill this requirement it will be necessary in the first case to keep three airplanes in continuous operation, while with the light power plant the same work can be done with only two planes, and the relative transportation costs per ten mile will be 50% greater when using the heavier engine than when using the lighter engine.

The Development of Lighter-Than-Air Craft

IN AN address before the Affiliated Technical Societies of Boston at Tremont Temple, Mr. Edward Schildhauer, E. E., of the National Aeronautic Association of U. S. A. discussed the development of lighter-than-air ships, in which he brought out some unusual features concerning airships for commercial transportation. Mr. Schildhauer is a world authority on airships, being the Chief Engineer of the American Investigation Corporation, and he also achieved fame as the Chief Electrical Engineer of the Panama Canal, being the designer of the electrical equipment operating the locks and towage systems employed at the great water-way.

The meeting of the Affiliated Technical Societies of Boston was designated Commercial Aviation night, and other speakers were Professor E. P. Warner, Aeronautical Engineer of the Massachusetts Institute of Technology, and James T. Williams, Jr., Editor-in-Chief of the Boston Evening Transcript,—the meeting in particular being held in connection with the opening of a landing field at East Boston, to be known as "Boston Air Port."

"In comparison with Endurance flights of airplanes," stated Mr. Schildhauer, "the airship leads by a tremendous margin. The world's endurance flight of heavier-than-air craft is between 35 and 36 hours, and the greatest distance in single flight record of such craft is a little over 2,000 miles; while in the case of airships, the German Rigid L-59 during the war made a trip from Jamboli, Bulgaria, to a point beyond Khartoum, Africa, and return, in 95 hours, and travelled 4,500 miles. The British Rigid R-34 crossed the Atlantic, remaining in the air on the trip to America over 100 hours, and flew over 75 hours on the return journey, while airships of even smaller dimensions have remained over the North Sea for more than 100 hours at a stretch.

"These feats of long distance endurance flight made by airships", continued Mr. Schildhauer, "point to the airship as the supreme vehicle for long distance aerial transportation. Heretofore the modes of transportation have been limited by terrain: the wonderful railroad systems have come to an end at the seaboard, where connections may be made with ships. The airship, which uses the air as a pathway, has no such limitations. It therefore follows that the best seaport may not necessarily be a convenient harbour for airships. Generally, there are advantages in combining the facilities of a seaport with an airship harbour, but, on the other hand, an inland city may have other facilities and advantages which outway the favorable points of the seaboard city."

Mr. Schildhauer brought out the fact that in studying the future development of airship transportation in America, giving due weight to the present transportation facilities, the conclusion seems to be that Chicago is a logical location for a main harbour. From the standpoint of national defense, Chicago also is in a favorable position."

Chicago, he pointed out, has made a start toward the establishment of an airport, but, like other cities, has not yet been able to arouse the public to the great advantages accruing to any nation which is first in the field in the development of airship transportation. The path of an airship is not limited by the banks of a lake or the shores of an ocean, and as a consequence the theoretical path between two cities may be in a straight line. The shortest airship route between Chicago and Moscow, for instance, passes over the northern part of Labrador, the central portion of Greenland and Norway, over Petrograd, then southeast to Moscow—a total distance of approximately 4,800 miles. A route from Chicago to London would pass over the southern portion of Labrador and a few degrees south of Greenland—a total distance of about 3,800 miles. The Chicago-London route, via New York and Boston, is only 180 miles longer; therefore, it should be expected that even though the trans-Atlantic ships would start from Chicago, they would stop at New York and Boston to take on passengers and express matter, together with fuel and supplies at Boston.

Going west, similar conditions exist, as shown by the route from Chicago to Tokyo and Manila, which passes over the central portion of Alaska, thence touching Kamchatka, and following the group of islands to Tokyo—a total distance of 6,000 miles, whereas the distance from Chicago to Tokyo via Seattle is only about 200 miles longer.

Just as benefits accrue to the nation first in the field of airship transportation, so they will apply to favorably located cities in America, and in spite of some disadvantages, it is within the realms of possibility that Boston will become the preeminent airport of America, if the proposition is prosecuted in a comprehensive manner. Boston is well situated for an eastern terminus, as the manufacturing towns of high-grade articles are within easy reach of Boston by means of airplanes. In explanation of this, Mr. Schildhauer stated that airship and airplane harbours should be located as closely as possible to present centers of activity and facilities for surface transportation. It should be a combined airship and airplane harbour, because there is no question in the mind of those who have studied aerial navigation that the time will soon arrive when the principal high class transportation will be done by means of aircraft, both lighter and heavier-than-air.

"It is my opinion", he continued, "that safe night flying by airplane has not yet been solved, but it is entirely solved by the use of airships. Therefore, in order to put 'America First in the Air', night flying should be done by airships and the schedule so arranged that the landing will be early in the morning so that, from the same field, airplanes will take individual passengers, or groups of two or four, to the outlying districts and cities within a radius of 200 to 250 miles, arriving at their destination early in the forenoon. This can also be done, of course, in the case of high class express matter and mail by the employment of airplanes in conjunction with airships.

"While Boston may become the eastern terminus, it is not as well situated for the purpose as the metropolis of the middle-west—Chicago. In fact, no Atlantic coast city is so favorably situated; and in order that Boston may reap the benefits of aerial transportation, it should start at the earliest possible moment to lay out a harbour on a comprehensive scale, and induce aircraft companies to utilize the field, thereby building up the industry and gathering the lines in the early stages, to form the nucleus of future growth."

In speaking of the progress of airships for commercial purposes, Mr. Schildhauer called attention to the remarkable performances of the German Rigid Bodensee which, with accommodation space for 24 passengers, in 1919, until stopped by the Allied Powers, operated for 101 days, and carried 2,380 passengers between Berlin and Friedrichshafen, making practically 98% of her scheduled trips. "In fact", said Mr. Schildhauer, "European airship development has progressed within the last decade from the experimental stages to an accomplishment whereby passengers may be transported safely over long distances, and follow a predetermined schedule. Thousands of passengers have been transported in passenger airships in Europe, and not a single casualty has occurred.

"In the United States, with helium as a buoyancy medium and the employment of the mooring mast to obviate the danger of handling ships on the ground (a measure which also reduces the expense of operation), there can be no question with respect to the desirability and the safety of airship navigation on a grand scale. Engine improvement, luxurious and comfortable quarters for passengers, highly developed navigational instruments, and the ability of airships to maneuver around or above local storms, make it a foregone conclusion that such ships will be in operation in this country in a very short time, for not only will a needed adjunct to present transportational systems be provided, but the problems of national defense will be correspondingly simplified."

In conclusion, Mr. Schildhauer urged that a general campaign for enlightening the public on this very important economic factor in the nation's transportational needs should be immediately put into effect, because what this country needs even more than landing fields and airports is public confidence and interest in aviation generally.

The Helicopter

A Review of the Latest Book by M. Margoulis, Former Director of the Eiffel Laboratory

By William Knight M. E.

If the only subject of the helicopter was to rise from the ground and to remain stationary in the air, this machine would probably be useful in connection with military operations only. In fact the first realizations of helicopter designs which made their appearance during the war had in view mainly the utilization of this new type of aircraft as a substitute for the observation balloon.

Later on, however, the trend of evolution of helicopter design has developed the commercial possibilities offered by this new type of flying machine and a number of types have been built with multiple propellers providing for the vertical and the horizontal displacement of the helicopter in the air. The question has since arisen as to the practicability of designing and building helicopters which besides being able to rise vertically in the air and to fly horizontally at any desired altitude and in any direction, can also be favorably compared to the airplane in so far as speed, useful load and fuel consumption are concerned.

In order to answer this question, what was needed was a basis of laboratory experimental work and an analytical method of approaching the problem. This has been supplied by the author in his book on "The Helicopter" recently published in France.

The experiments made by the author after 1918 at the Eiffel Laboratory and at the St. Cyr Aerodynamic Institute have enabled him to plot for the first time the general characteristic curves of a propeller for any position of its plane of rotation with reference to the trajectory of the aircraft. Also, he has devised a new graphical method of representation of experimental results obtained by others on propeller research work, which has thrown a considerable amount of light on the real meaning of a large amount of experiments made both in Europe and in this country which have been so far the object of many discussions and interpretations.

In the second part of his book, the author takes up the mechanics of the helicopter flight and he applies the experimental knowledge which he has reviewed, interpreted and co-ordinated in the first part. The vertical, the horizontal and the inclined regime of flight are considered in this second part of the book.

The comparison between the regimes of flight of an helicopter and of an airplane is established by the means of "polars" which so far have been mainly used in connection with the graphical representation of the aerodynamic characteristics of airplane wings. The graphical method used is the same which has been previously developed by the author in connection with the mechanics of the airplane flight.

One of the conclusions arrived at by the author in his book is that the hopes which have been based on the braking effect of propellers rotating as wind mills in checking the fall of an helicopter in case of a sudden stop of the motor, are not well founded because the velocity of the descent of the aircraft under these conditions would not be sufficiently retarded so as to insure a safe landing.

The study of the horizontal flight of the helicopter leads the author to the conclusion that, for the same horizontal speed of displacement of the aircraft in the air, the power required by the helicopter is greatly in excess of that required by an airplane. However these conclusions would have pointed out to a more favorable comparison between these two types of aircraft if propellers of a smaller pitch than those considered by the author had been figured upon in the calculations.

The study of gliding flight of helicopters, is referred to the case of an helicopter equipped with sustaining wings, and the graphical method used in the analysis of its performance is due to Prof. Joukowski and to the author. This analysis shows that, same as in the case of an airplane having a great excess of power, a regime of flight (unknown up to the present time) exists which offers a number of peculiar characteristics, as for instance, the reversal of the action of control planes.

The discussion of the various problems related to the mechanics of helicopter flight has been developed by the author in a very general and most comprehensive way, especially due to the introduction of graphical methods of calculation and to the use of transparent sliding diagrams which have been developed by the author and which constitute a great contribution to the art of nomography.

Both from the point of view of experimental aerodynamics and from the point of view of nomography, Mr. Margoulis' book on the helicopter is extremely interesting and useful.

Most of the work contained in this book and especially the analysis of experimental research work on propellers contained in the first part of the book (pages 1 to 36) and the first chapter of the second part dealing with the mechanics of the vertical flight of an helicopter (pages 45 to 51) were first presented by the author in the "Technical Review of Aeronautics" issued monthly by The Paris office of the National Advisory Committee for Aeronautics and edited by that office as a confidential technical report on aeronautical progress in Europe. The publication of this review was discontinued in 1921—copies of this review are now filed in the libraries of aeronautical technical organizations in Europe and the National Advisory Committee for Aeronautics, Washington, D. C.

"The Helicopter" by W. Margoulis, former Director of the Eiffel Laboratory, Paris, published by Gauthier-Villars & Co., Paris, France.—31 pages, 21 diagrams.

Modern Air Transportation

By W. Wallace Kellett

An Airline is very much like a railroad. In both cases the object is the same—transportation. Both require terminals, a route, rolling stock and trained personnel.

Every one knows in a general way the tremendous organization, efficiency and accuracy necessary to the operation of a successful railroad. When traveling, however, we rarely think of the roadbed, the steel rails, the block-towers, switches and the host of men who are personally connected with every movement of every train.

So with the Airliner. Some of the passengers on the London-Paris Airliners recently asked why the pilot was continuously talking to himself while they were in the air. They could hardly believe it when told that the pilot was not talking to himself, but with Paris, London and the other ground stations on the route by means of the wireless telephone with which all these liners are now equipped.

This is only one of the marvels of the airlines. By wireless, the pilots receive full reports of weather and flying conditions all along the route and can also ask for any information they desire.

Photographs showing the guide board for the use of pilots and officials at the LeBourget Airport, Paris, are perhaps the finest evidence of the high state of efficiency which has been reached in the operation of Continental Airlines.

By a glance at this board the pilot can tell just what kind of weather he will have on his day's trip and how long it will take him to reach his destination. In the upper left hand corner is the tableau for the Paris-London, the Paris-Brussels and the Paris-Amsterdam route.

The following indications appear on this tableau—the weather at the time, the weather predicted and the "air soundings" telling the velocity of the wind and character of the air at different altitudes.

These reports are sent in hourly by radio from all the stations on the route. They are made by men who have experience, know their business and can be counted upon not to err.

In the lower left hand corner is the tableau for the Paris-Strasburg route. The "Observations", "Previsions"

The "arrival" and "departure" boards at a French airport and "Sondages" are easily distinguished on this tableau.

In the center is the great map showing all the cities on the Continent and in England traversed by the Paris air-routes.

The clock dial in the upper left hand corner shows the time of the last report.

The arrows indicate the direction of the wind in each city. The small disks on the arrows tell by their color the exact state of the weather.

The small white tags hanging from the arrows state the exact ground velocity of the wind.

Even a person quite unfamiliar with the system can understand this map after a few minutes study.

To the right of the map is the cloud-tableau. It also has a clock dial in the upper left hand corner indicating the hour of the last report. The reports, incidentally, are made hourly.

This tableau tells the altitude of the clouds at the various points along the route. This is very important, as pilots must know whether they may fly above the clouds with safety or must fight their way through beneath low clouds, and in the latter case, how long these low clouds will continue.

The cloud tableau indicates cloud altitudes up to 6,000 ft. The altitudes are indicated by the height of the light strips which are read by means of the scale on the left hand side.

On the day this photograph was taken the height of the clouds varied from 1500 ft. to 6,000 ft. Where a strip is entirely covered by the dark shutter it means that no report has been received during the hour from the town represented by that strip.

Finally, the small bulletin board on the far right gives special indications to pilots concerning conditions at the air terminals such as, for example, soft ground due to rains, part of the field occupied by workmen, temporary obstacles such as grass mowers, which must be avoided, etc.

Information charts and maps used at the Le Bourget Airport

The second illustration shows the entire flying-board at LeBourget. It gives an idea of the compactness, simplicity and completeness of this installation.

It is equipment of this kind which forces us to realize what the operation of an airline really means.

The indications which appear on the flying boards at Paris, London, Brussels and the other European Airports are not the result of magic. They come from thousands of dollars worth of special equipment, a trained personnel and last but not least, the experience of four years operation of commercial air transportation lines.

The boards showing the "Departs" (Departures) and the "Arrivees" (Arrivals) are also interesting. Each machine which arrives at, or departs from the airport is recorded on these boards.

First is given the name of the airline to which the machine belongs then come in order, the license number of the machine (all airlines must have Government licenses), the destination to which it is flying, the time of departure, the time of landing, the cargo it carried, and last the location where it landed, expressed simply by the word "Arrivee" if the machine reaches its scheduled destination without stop, as is usually the case.

So we see that it takes a great deal of equipment to make an airline. Even now we have considered only a small part of the necessary material.

The Cycle Theory In Flying

NOTHING new under the sun. It's always been already done. Trade Cycles, cycles in flying.

The air cooled engine is coming in for interest as a new development and the prophecy is made by a prominent manufacturer that in four years practically all aircraft engines will be air cooled. Yet little more than a decade ago, say thirteen years back, the best known and most successful engines were all air cooled. The Gnome dominated the field.

Balloon observers of 1918 thought they were participating in a new phase of warfare. Count Zeppelin watched our military balloons in 1861; and they were used again in 1898.

The Army airship flew over New York in 1922. Solomon Andrews did it in 1863.

1922 Model Airway towns advertised themselves with air markings. In 1909 the word "Amherst" in 35-foot white letters marked the introduction of airway signs.

In 1923 the Bothezat helicopter built with great secrecy by the Air Service, proved that Newton Williams and Emile Berliner were right in 1909, by duplicating their achievement.

The Government's little known but much discussed manless automatic airplane of the period 1918-1923, was much more fully described by Emile Berliner in 1909, whose device had all the features of the machine of today.

Well, how about night flying. They certainly didn't do any of that stuff in the dear, dead days beyond recall. Well, Noah, and Jonah and Cap'n John Smith didn't for a fac'; but Charlie Hamilton did and is probably sittin' on the same cloud spielin' about what *he* used to do at Camp Dickinson, in 1910.

Federal control of flying and we're all het up over a bill that doesn't seem to pass. The Department of Commerce, it seems, decided in 1914 that flying boats, at any rate, were "vessels" when they were on the water and demanded they meet requirements. Licenses were granted and fines imposed under the law.

Commercial transportation. Florida airways. Sure thing. Tony Jannus flew the old Benoist boat back and forth during the season of 1914 between Tampa and St. Petersburg at $10 a fare and made money.

Oh, but the X engine of McCook Field. W. Starling Burgess will be interested in this, for he built one of 'em in 1914.

Hundred per cent performance for the Air Mail. Chief Egge deserves all the credit in the world. The Air Mail is the greatest flying demonstration ever put across. But the idea is old. Air mail, trans-atlantic, was proposed to this country by a German airship inventor in 1902. In 1908-1909 Senator Sheppard urged air mail. In 1911 Postmaster General Hitchcock inaugurated an honest-to-goodness service on Long Island, with Earle L. Ovington as first pilot, making scheduled trips between two post offices with one hundred per cent efficiency for the week.

Modest Modesto, Calif., provided in its 1911 charter for a municipal aerodrome "when needed," and Kissimmee—don't laugh—, in Florida, booked the first American, at least, aircraft ordinance, in 1908.

The Germans last year made some wonderful straight gliding records. Maloney, in the Montgomery machine, in 1905, did acrobatics from 4000 feet height, having cut loose from a balloon, used to get a little altitude for the start.

Gas bombs from aircraft are being figured on for the next war. Tony Jannus thought of gas from airplanes when he took Bert Berry up at Jefferson Barracks, in 1912, on the world's first parachute drop from a plane, and told the press about it.

Speaking of parachutes, parachute jumping with the shoulder pack was an old story by the end of that year and in 1923 the Government is defending the suit of an inventor. The original parachute jumper however was Sebastian Lenormand who jumped off a tower with a big umbrella in each hand, the day after Christmas, 1783.

Muffled engines for commercial lines, when established, are being considered. The Army used 'em in the Burgess machines of 1912.

Aerial photography a development of the war? Exactly. But Bob Fowler used to take 'em with a motion pitcure camera on his transcontinental flight in 1911.

Transcontinental flights were getting common then. This was the second one. Cal Rodgers had already ended his.

The newest types of aircraft engines now have starters. Starters were the mode in 1911.

The enemy wasn't worried much in 1918 by American archies. They were comparatively new. We had had them only 9 or 10 years, since Dr. McLean demonstrated one in Cleveland in 1909 and the Army and Navy had each built their first experiments in 1911.

Here's Earl Findley goes and leaves the Air Service flat and sets himself up as editor of the newest air magazine. There's nothing new in that. Not for Findley, there isn't. Findley was writing aeronautical beats in 1908 for the New York Tribune; and the first American aviation magazine—yes aviation; for it dealt mostly with heavier-than-air dope—was the "Aeronautical World" helped along by Chanute in 1902 and just about as successful as the Bothezat helicopter.

And these ain't all, neither!

Aerial Mapping By The Geological Survey

By C. H. Birdseye, Chief Topographic Engineer, U. S. Geological Survey

The Truth about Mapping—60 Per cent of U. S. Unmapped—Temple Bill Would Map by Air in 20 Years 1,800,000 Sq. Miles—Using Army and Navy Air Service Cost Reduced One Fourth—Improvements Needed in Cameras— Aerial Photos Will Not Supplant Ground Work—Need for Private Enterprises—Editor.

THE topographic maps of the country are made chiefly by the United States Geological Survey, which is charged with the work of making standard topographic maps in quadrangle form of the whole area of the United States. In this work, many States co-operate by furnishing funds to pay part of the cost. Special military maps are made by the Corps of Engineers, but duplication of work is prevented by close co-ordination between the two organizations. The Engineer Department of the Corps of Engineers and the Mississippi River Commission make certain topographic maps of areas, primarily for river and harbor improvements. The Forest Service and the Reclamation Service make special topographic maps, but only of areas where the Geological Survey is unable to do the work on account of lack of funds and personnel. Cadastral maps and plats are made by the General Land Office, particularly to show the results of the public-land surveys. The United States Coast and Geodetic Survey is making hydrographic surveys of our coastal waters and publishes this data in the form of charts designed primarily for use in navigation. The Hydrographic Office of the Navy Department makes similar surveys and charts of contiguous and foreign waters. The United States Lake Survey makes hydrographic surveys and publishes hydrographic charts of the area of the Great Lakes.

Almost every bureau or office of the United States Government uses maps, plats, or charts, but most of these organizations do not make them, they use the base maps, plats, or charts prepared from field surveys made by the principal Federal map-making agencies.

The area of the continental United States, exclusive of Alaska, is about 3,000,000 square miles, about 40 per cent of which has been covered by topographic surveys whose results are published by the Geological Survey in about 3,000 separate maps. There remains to be mapped about 1,800,000 square miles, and if the work is done at the present rate it will take more than a hundred years to complete the job. By that time at least 75 per cent of the maps will have become obsolete as regards cultural features and will need revision.

The Temple bill (H. R. 10057), now pending in Congress, authorizes the mapping of the entire unsurveyed area in twenty years. In connection with this project the fullest possible use of aerial photographs has been planned, and their use will undoubtedly make a large saving in both time and cost,—how large depends on the amount of co-operation that the flying services can give and on improvements in flying and photographic equipment. In its plans for this work the Geological Survey does not contemplate the creation of its own flying or photographic service. If the air services of the Government can, in connection with the necessary training of its personnel, photograph the areas to be mapped by the Geological Survey, the project will be expedited and the Government will save more than one-fourth of its total cost. If the Federal air services can not meet this need, and the Geological Survey has to make contracts with private aerial photographic firms for the service, the saving in cost will be problematical. Under the present conditions the cost of the work under such contracts would be prohibitive as ground surveys for maps on the scales used by the Geological Survey can be made about as cheaply as aerial surveys. Airplane photographs can not yet be used to determine relief, so that the field engineers must go over most of the ground in order to obtain the data for the contour structure.

Assuming, however, that the Geological Survey will have the hearty co-operation of the air services, we may say that the future of aerial photographic surveys in connection with topographic mapping is bright, and moderate estimates indicate that this assistance will save about 30 per cent in the cost of mapping.

Enthusiastic proponents of aerial photography have created a general impression that an accurate map of a region can be made by taking a number of airplane photographs and pasting them together. This operation, however, gives a distorted photograph of the ground, properly called a mosaic, which is not in any sense of the word a map, and unless the photographs are rectified and tied to well-established ground control a map made from them will contain serious errors. The topographic maps prepared by the Geological Survey are quadrangular units, each of which is an integral part of the topographic atlas of the United States. As these parts must fit together perfectly, they should contain no cumulative errors, such as those that are inevitable in surveys not based on accurate geodetic control.

Too many fliers and photographers who are totally ignorant of the fundamental principles of accurate map making have made enthusiastic claims that air photographs will completely do away with ground surveys. They have led many to believe that the United States can be completely mapped in an amazingly short time and at a cost that would be insignificant as compared with that of mapping the country by ground surveys. The result of this belief is that the mapping activities which are essential to the proper use of air photographs are being curtailed under the supposition that the "mosaic" will replace the results of ground surveys.

It is still impossible to map relief by means of airplane pictures. The topographic maps of the Geological Survey are essentially relief maps, the slope of the land and the differences in elevation being shown by contour lines based on spirit leveling reckoned from mean sea level as a datum. European scientists and experts of the Army Air Service at the experiment station at McCook Field are trying to devise a process by which relief can be shown accurately by airplane pictures, but so far with very little practical result. Such a process that will be commercially practicable may yet be devised, but only after many years of research and experiment. It is therefore evident that the topographer must go over the ground thoroughly enough to map the contours, and while he is doing this work he can, in many areas, meander the streams, roads, and trails without much additional cost. For certain areas therefore the only advantage afforded by airplane photographs will be an increased exactness in minor detail and a graphic record that will eliminate field inspection.

Airplane photography in topographic mapping will probably be of greatest value in the revision of old surveys. It is obvious that a more accurate and complete revision of the culture—the roads, railroads, buildings, etc.,—can be made by the use of airplane photographs than by additional field work, which is likely to be only fragmentary.

The methods employed and the results obtained in aerial mapping have not reached a point where the photographs can be used for making maps of all kinds, but the practical demonstrations made during the last three years by the Geological Survey have proved beyond doubt that they can be used extensively in connection with the topographic mapping of the United States on the scale of 1:62,500 (approximately 1 inch to 1 mile), except in rough, mountainous or heavily timbered areas.

Although, so far as the Geological Survey is concerned, airplane photography can not entirely supplant ground work, nevertheless it is the most valuable aid to topographic mapping that has been devised since the plane-table was perfected, and the Geological Survey proposes to use it to the fullest extent and to assist as much as possible with the funds available in the development of new methods and new instruments.

The Geological Survey made its first practical use of aerotopographic mapping in the survey of the Schoolcraft quadrangle,* in Michigan, in 1920. In this area, which includes 220 square miles, 273 photographs were taken by the Army Air Service. The total time consumed in the work was five days, including the time consumed in round trip flying from McCook Field. The actual time employed in taking the photographs was only seven hours, and the total cost of the photographic work, exclusive of the pay of the officers, was $712, or $3.50 a square mile.

The Geological Survey had already established the ground control and had made the base-map projection on which the control points were plotted and the land-line network adjusted before the photographs were used; and this is the correct procedure for maps of this class covering areas where the public land-line system is marked on the ground by roads or fences that will be shown on the photographs. The photographs were joined together in small mosaics, about four pictures to a mosaic. All the features on the photographs that would aid the topographer, such as roads, houses, streams, swamps, fence lines, and timbered areas, were inked on these small mosaics. The photographs were then bleached, leaving only the inked lines on the photographs which were on the scale of 1 : 15,000. These inked photographs were reduced by photography to the scale of the base map, 1 : 48,000, and were adjusted to the control and the land-line net laid down on the base map, fence lines in the photographs being registered over the section lines plotted on the map. Except at a few points a perfect adjustment was obtained. The combinations of small photographs thus made were then re-photographed and printed in non-photographic blue on field plane-table sheets and sent to the field for contour sketching by the usual ground methods.

The cost of preparing these field sheets was about $1.50 a square mile, so that the total cost of the photographic work was less than $5 a square mile. The wealth of detail shown in the photographs, such as the drainage, fence, and timber lines, enabled the topographer to make a great saving in the cost of the ground survey, which was $20 a square mile. The cost of the office drafting was $3 a square mile, so

* See Air Service Information Circular No. 184, "Use of Aerial Photogragths in Topographic Mapping."

that the total cost of the survey was $28 a square mile. Similar work done in adjacent areas by the usual ground-survey methods cost about $40 a square mile, and the saving was therefore $12 a square mile, or 30 per cent. Here then, is the figure that indicates the average saving by the use of aerial photographs.

During the same year Bibb County, Georgia, which has an area of 275 square miles, was photographed to enable the Geological Survey to compile a county map for the Bureau of Soils. In this area, as there were no public land lines to use for the control of the photographs, the topographic engineers ran many control traverses to which the data taken from the photographs were adjusted. During the year 1922 the Memphis and Nashville quadrangles, Tennessee, and the East and West Cincinnati quadrangles, Ohio, were photographed by the Air Service at the request of the Geological Survey, so that the culture could be revised to date. Part of the Mississippi River valley near Reelfoot Lake, Tennessee, was photographed, and the data made it possible to map the area with very little ground surveying. An aerial photographic survey of Los Angeles County, California, is now planned for use in connection with detailed surveys being made in that county by the Geological Survey.

The first investigations in aerophotographic surveying undertaken by the Geological Survey were made by J. W. Bagley, of the Survey, now a Major in the Corps of Engineers who for nearly ten years employed the panoramic camera for topographic mapping in Alaska. Major Bagley undertook to adapt to topographic surveying in this country the principal features of a method conceived by an Austrian army engineer, Capt. Theodor Scheimpflug. This method differs from others in that the field of view of the picture is increased by employing a multi-lens camera, or a battery of cameras, for making a number of simultaneous exposures. Each photograph overlaps one or more of the others, so that the product is a composite photograph made up of all the others. The camera devised and employed by Major Bagley is a tri-lens camera. One lens is pointed directly down and the other two are inclined to it at a fixed angle. The distortion arising from the differences in the inclination of the axes of the lenses is corrected by an auxiliary rectifying or transforming camera, which, like the tri-lens airplane camera, was designed in the Geological Survey.

The work was begun in the fall of 1916. Money for constructing the first airplane camera and the transforming camera was provided by the Council of National Defense, and the instruments were ready for trial in the fall of 1917. Major Bagley and Mr. Fred H. Moffit, of the Geological Survey, spent the end of 1917 and early part of 1918 at Langley Field, Virginia, in experiments with the camera. Early in 1918 the Corps of Engineers became interested in the work and provided money to build nine additional airplane cameras and seven transforming cameras, and from that time to the present the Corps of Engineers and the Geological Survey have collaborated in this work. Major Bagley was sent to France in 1918, and the investigations in airplane photography were continued by his associates Mr. Moffit and Mr. J. B. Mertie, of the Geological Survey. The first problem considered was that of stabilizing either the camera or a reference point or line from which to measure the deviation of the picture from its correct position. This work was done in collaboration with Lieut. W. A. Hyde, of the Science and Research Division of the Air Service, at Langley Field. A gyroscopically controlled airplane camera was constructed in January 1919, and was tested in a series of flights extending over several weeks. The results were encouraging, but owing to conditions that followed the demobilization of the Army, the work was not completed. The problem of stabilizing the reference point rather than the camera is now under consideration. Dr. L. J. Briggs, of the Bureau of Standards, was asked to assist in solving this problem and has devised an instrument, adapted to the tri-lens camera, by which a stabilized reference point is sought through the use of a gyroscope. Tests of this camera were made at McCook Field in 1921.

Air photographs will no doubt hereafter be used in all kinds of mapping and in solving some engineering problems, but before they can be of much practical value, other than in government map making, there must be greater facility for obtaining the use of privately owned aircraft, manned by specially trained fliers in order to obtain data by photographs at a cost no greater than that of obtaining the same data by ground work.

Airplane photography is in its infancy, but it will no doubt eventually become highly useful in making maps and will replace many of the ground methods now employed, but before it can do even this economically an immense amount of experimental work must be done in perfecting photographic methods and lessening the cost of photographic and flying equipment.

(*Concluded from page* 219)

open to inspection and only straight cables and levers without pulleys are used. The stabilizer is adjusted from the pilots' seat by means of a very simple worm gear, of which the actuating rods also pass outside the fuselage.

The cabin is probably the largest compartment yet provided on such a comparatively small plane. Including the entrance space and the toilet the total length of the cabin space is 14 ft., while there is sufficient head room for a 5 ft. 10" man to stand upright, the width of the cabin which is 5 ft. provides plenty of space for the two rows of 4 chairs which are normally fitted for passengers.

The cabin is well lighted by 4 large windows on each side, all of which can be slid open. Above the windows sliding ventilators admit clean hot air from a jacket surrounding the exhaust pipes when required. These pipes are carried way back of the cabin through which the noise is greatly reduced.

Behind the actual passenger cabin there is a kind of entrance hall in which considerable baggage can be placed or alternatively, another seat. After the entrance a very roomy lavatory is fitted up with the usual toilet, washing and drinking facilities.

The door is so close to the ground when the airplane is at rest that no step or ladder of any kind is necessary. There is a lock up baggage hold of 48 cubic ft. capacity, accessible only from the outside underneath the floor of the pilot's cockpit.

The fuselage construction throughout is on a completely new principle; the actual work is the usual Fokker welded steel frame construction, but the tubular members are built into wooden box members and the entire fuselage, with the exception of the engine section, then covered with 3 ply veneer which forms at once the covering, the bracing, and the cabin walls While the rigidity, practically indefinite durability and ease of repair which characterize the steel tube structure are in this way retained, all bracing wires which usually require occasional adjustment, and fabric, which on most airplanes requires replacement fairly often, are done away with.

The stabilizer is covered with veneer, like the wings which makes it very stiff and prevents any flutter. The elevators and rudder are of the usual Fokker steel tube construction and fabric covered. The same applies to the ailerons.

The landing gear is of a new type which has been fitted to all the most recent Fokker machines.

Some Phases of the N. A. A.

By Conway W. Cooke

Chairman Membership Committee National Aeronautic Association of U. S. A.

NOT only the permanency but the actual functioning of the National Aeronautic Association depends in a large measure upon the number and strength of its local chapters. As a matter of fact every chapter of the Association becomes one of many similar local organizations linked and banded together into a complete and working whole through the medium of the Association's district and national headquarters. This affects a collective influence always exerting its strength toward the expansion of present national aeronautic activities into a great industry manufacturing and operating aircraft throughout the entire country.

A uniform effort on the part of local chapters wherever situated, either north, east, south, or west, harmonized and co-ordinated by the national and district headquarters into a smoothly working program will most quickly and efficiently carry out the purposes for which the N. A. A. was founded, those purposes being to foster, encourage and assist the development of commercial aeronautics in America for the following desirable ends: Prosperity in peace and security in war.

In last month's issue of *Aerial Age* will be found an official bulletin of the Association giving a memorandum on chapters with their by-laws and other data explaining the benefits to a community in which a strong chapter is located. It will readily be seen that through the chapter committees every civic, business, professional and social organization in the community puts its shoulder to the wheel and directly assists in the advancement of aeronautics as a local problem.

But, in addition, through the system of organization employed by the Association every chapter receives the moral support of the national and district headquarters and hundreds of other chapters engaged in the self-same mission. Thus the influence of every chapter extends far beyond its immediate vicinity until it reaches throughout the entire country. This makes for a powerful organization, one which can even *demand* that proper measures be taken by cities states and the Nation for the safe and sane regulation of air navigation.

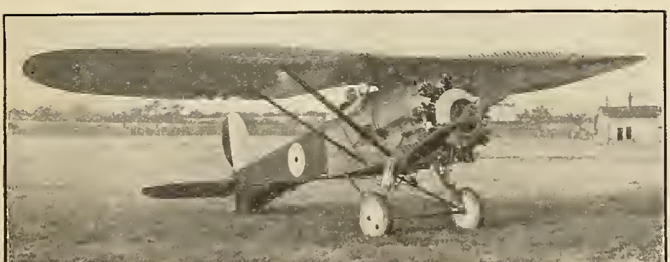
Every chapter being a unit of the national organization, through the national standing committees, can secure for itself a share in all of the activities of the Association, including the service of a speakers' bureau, the licensing and regulation of contests and meets, the dissemination of aeronautical information, and the thousand and one activities which the Association as a national body undertakes for the general welfare.

It will be readily understood that the organization of the N. A. A. along these lines is an undertaking of great magnitude and that the organization of local chapters throughout the country is a problem requiring the earnest co-operation of all those interested in aeronautical affairs. Consequently, as the most logical immediate solution of the problem in hand, the N. A. A. is now conducting a nation-wide campaign for membership and the establishment of local chapters throughout the districts.

Campaign committees have been organized in the districts and such prominent men as Colonel Edgar S. Gorrell, President of the Boston Marmon Company; Charles A. Moffett, President of the Gulf States Steel Company, Birmingham, Ala.; Samuel M. Felton, President of the Chicago and Great Western Railroad; Joseph Pulitzer of St. Louis; Dr. Frederick Terrell, President of the City National Bank of San Antonio; Cecil B. De Mille of Los Angeles, and others have accepted the chairmanship of these committees.

All these committees, together with experienced organizers in each district, are preparing the ground for an intensive personal-contact campaign during the month of May, when local chapters will be organized in the cities and large towns from coast to coast. This movement is meeting with the heartiest enthusiasm throughout the country and cities are now competing with each other in an effort to gain for each city concerned the largest local chapter in the Association.

It is hoped by the officers and present members of the Association that each reader of *Aerial Age* will peruse the bulletin, particularly the memorandum on chapters, with the avowed purpose of fitting themselves into the particular committee or phase of work of their local chapters which they find most agreeable, and thus assist in making the membership campaign a success. By so doing they will be placing their own community on the aeronautical map of the country, and also joining in the efforts of the Association to make its slogan "America First in the Air" a reality.



The Bristol Bullfinch—a new acquisition of the British Air Ministry

N. A. C. A. Control Position Recorder

IN the study of airplane stability, controllability and maneuverability a knowledge of the position or movements of the control surfaces is essential. Heretofore, the method was to visually read the angle. This was slow and inaccurate. The device built by experts of the National Advisory Committee for Aeronautics gives more data in a few minutes than could be obtained by old methods in many hours. Even the cost of research has been reduced.

Another use of the instrument is for the study of control movements in various kinds of maneuvers. This is quite important as a pilot usually can not remember exactly how he moved his controls in order to execute a given stunt. Many know what they do but find it difficult to describe to a layman, or even to a flight student.

This instrument may be utilized simultaneously with the Committee's air speed meter, control force meter and the accelerometer, with the positions of the controls, the speed, the forces acting on the controls and the loads at a plurality of locations all recorded photographically, furnishing a complete chronology of any maneuver.

The record produced by the control position recorder illustrates simultaneously every movement of the rudder, ailerons and elevator during any period of time in any operation. The student has a photograph of the "stick" at each portion of a maneuver.

A comparison of ability may be had. The new student, or the applicant for a flying certificate from a school or from the Government should a federal bureau be organized, can see a photographic record of his execution of a maneuver alongside the record of a skilled pilot.

The instrument consists essentially of a base plate and film drum used on all N. A. C. A. recording instruments. A consistant speed clockwork driving motor (1) rotates the film clutch (2) at a speed of about 1 r. p. m. through worm gearing in

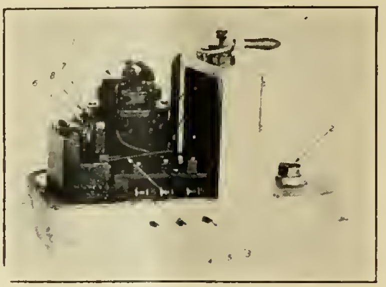


Fig. 1

the base. The motion of the controls is transmitted to the instrument through the cords (3) which are wrapped around three drums (4). The drums are mounted on a horizontal screw and contain a spiral spring which keeps the cords wound tightly. Thus, a 12-inch motion on the end of the cord is converted into a 3/16 inch lateral motion of the drum. This motion is transmitted by a system of levers (5) to three mirrors (6) which reflect the light beam from a tungsten lamp onto the moving film through the lens (7) in the same way as with other N. A. C. A. recording instruments. Three separate records are superimposed on one film, a continuous line, a dotted line and a dash line, accomplished by revolving slowly in front of two of the mirrors a sector shutter (8).

The cords can be connected directly to any convenient portion of the control system, but if it is desired to have a high degree of accuracy, it is advisable to run small steel wires to the control horns so that any backlash in the control systems may be eliminated. If this is done, a precision of 1/4 degree can be easily obtained, and this is quite sufficient for any ordinary work. The instrument is calibrated in place by setting the control surfaces to given angles and taking a short record on the film for each setting.

Some records taken by this instrument mounted on a JN4H, are shown in Fig. 2. Although they are not as clear as the original film the different records can be distinguished. The curves are usually re-plotted by measuring the distances on the film from the zero line and then multiplying by the calibration constant to give the true angle in degrees. These angles are then plotted against a time base so as to agree with the records from other instruments. The record of the landing shows the three-second vertical timing lines placed on the film by a light in the instrument case which is connected, together with timing lights in other instruments, to an electric chronometer.

In Report No. 112, "Control in Circling Flight," published by the National Advisory Committee for Aeronautics, there is summarized a great volume of work done in the investigation of forces and positions of controls and in the obtaining of data on behavior of an airplane in turns.

Fig. 2

Sand Point Aviation Field

Sand Point aviation field, Seattle, Wash., has a total area of 269 acres of which 40 acres is cleared and in condition for flying. This cleared area comprises a strip 500 feet wide and about one-half mile long north and south. There are no obstructions, the water being directly in front of the north approach and southeastward of the south approach. Owing to the prevailing wind there is no cross wind.

The Army Air Service has arrangements with the navy to use Sand Point Field for peace-time flying activities and has sent an overseas steel hangar to the field, which is now in process of erection. This hangar will be placed on the water so that it will be available for both sea planes and land planes; it should be ready for use not later than May 1, 1923.

Major H. C. K. Muhlenberg, Army Air Service, who is in charge of the R. O. T. C. Air Service, University of Washington, lives in the field quarters.

Approx. position: 47° 41′ N., 122° 15′ W.

Government Publications On Aeronautics

Army Air Service and War Department

IN accordance with the policy of providing the readers of *Aerial Age* access to official American literature on Aeronautics, there is printed following a series of lists of documents available for reference in Public Libraries, the Army Air Service Library and in some cases by purchase from the Superintendent of Public Documents, Washington, D. C. Many of these were issued for official purposes during the war but are now possible of study by anyone interested.

Two lists of the publications of the National Advisory Committee for Aeronautics have previously been published, in the November and December numbers.

The lists first above mentioned are divided as follows:

Air Service Information Circulars (aviation)
Air Service Information Circulars (Aerostation)
War Department Documents (relating to Aeronautics)
Air Service Miscellaneous Publications
Air Service Letters of Instruction
"U" Stencils

Primarily intended for official use and consequently issued in only a limited edition, many of these are out of print and only available for reference purposes. Correspondence in connection with these circulars should be addressed to the Chief of Air Service, Munitions Building, Washington, D. C.

One hundred Circulars constitute a volume, the last Circular of each series of a hundred being an index to the preceding 99.

VOL. I.

No.

1. Announcement of The Circular.
2. Report on First Transcontinental Reliability and Endurance Test
3. Air Medical Service
4. The Air Medical Service and the Flight Surgeon
5. Hispano-Suiza Engine, Model E & I, Ignition Timing Instructions and Chart (Dixie Type 800 Magneto)
6. Tentative List of Decorations Awarded U. S. Army Air Service, Am. E. F.
7. Enemy Aircraft Destroyed by U. S. Army Air Service
8. Destructive Whirling Test of "Micarta" Propeller and Rubber Covered Propellers with Hard and Soft Rubber Leading Edges
9. Test of Monel Metal Valves in Liberty Single Cylinder Engine.
10. Present Procedure in Static Testing of Airplane Engineering Division, U. S. Air Service
13. Tests of Various Types of Gasoline Hose Connections
16. Time Study of the Movement of the Firing Mechanism of the 37 m. m. Automatic Baldwin Cannon
17. Comparative Merits of Dixie Magnetos and Delco Battery Ignition System when used on Liberty "12" Aero Engine
18. Test of the Alsop-All-Spark Ignition Device and Measurement of Distances
19. Report of Test of French 37 m.m. High Explosive Ammunition
21. Aeronautical Book and Magazine List (out of print)
23. Report of Static Test on DH-4 (Dayton-Wright) Tail Surfaces
24. Report on Tests of Modified Firing Mechanism for the Baldwin 37 m. m. Cannon
25. Report of Static Test of Wing Cellule of Pomilio PVL-8 with Unequal Loads on Right and Left Wings.
27. Methods of Correcting the Longitudinal Balance of JN-6H Airplanes
28. Vibration Characteristics of the 300 H. P. Hispano-Suiza Engine
29. Report of Static Test of Fokker Type D-VII Chassis
31. Rate of Climb Indicators—Description and Theory (FOR OFFICIAL USE ONLY)
32. Report on Test of 37 m.m. Automatic Cannon on Cannon Engine.
33. Report on Wind Tunnel Test of Laddon Night Pursuit Airplane
34. Report of Static Test of the Fuselage of the D.H.4 (Dayton-Wright)
35. Comparative Test of Special Homogeneous Gasoline and Commercial Aeronautic Gasoline.
36. Report of Static Test of DH-4 (P-34) Wing Cellule
38. Report of Static Test of the Landing Chassis of DH-4 (P-34)
39. Structural Weight Analysis of Airplanes
41. Standard Engine Report on the Six-cylinder Benz Aviation Engine Rated at 200 H. P. at 1400 R. P. M.
42. Power Required to Drive Aeronautic Engine Magnetos and Generators
43. Report on Wind Tunnel Test of Messenger Airplane
44. General Descriptive Matter on Dopes and Instructions for the Application of Dope and Pigmented Protective Coverings.
45. General Descriptive Matter on Airplane Fabrics, Tapes and Cords, and Instructions for the Application of Fabrics to the Wings.
46. Aviation Gasoline—Specifications and Methods for Testing
47. Universal Test Engine
48. Storage and Preservation of Rubber Goods, Tires and Tubes—Liberty Ignition System Instruction Board
49. Report of Wind Tunnel Test on U. S. A. Aerofoils, 25, 26, 27, 28, 29.
52. Discussion of Stress Analysis of an Airplane with Cellule of the Multi-spar type of Wing Construction with Special Reference to the Loading Condition of the Standard Static Test
53. Properties of Woods at 10 per cent Moisture
59. Test Report of Marlin (7MG) Model 1916, after changes were made in Top Lock Container to Accommodate Single Shot Mechanism to be Used with Nelson Gun Control.
64. Standard Report on the 300 H. P. Hispano-Suiza Aviation Engine with Steel Cylinders
68. An Empirical Theoretical Method of Comparative Prediction of Airplane Performance
69. Air Service Reserve Officers—Officers who have accepted Commission in Aviation Section, Signal Officers Reserve Corps.
71. Performance Test of Fokker D-VII with Liberty-Six Engine
72. Notes on the Characteristics, Limitations, and Employment of the Air Service
73. Air Tactics
75. Tactical History of Corps Observation Air Service, A. E. F.
76. Notes on Recent Operations—General Principles—Corps and Army Observation—Pursuit—Day Bombardment—Balloons
77. Meteorology and Aeronautics—Location and Layout of Flying Fields Exploration of Upper Air—Forecasts—Light Charts—Magnetic Charts.
96. Manual of Aerial Photography (Provisional)
97. Official Airplane Report Form
99. Air Medical Service.

VOL. II.

102. A Method for Determining the Angular Setting of a Tail Plane to Give Balance at any Given Condition.
104. Report of Test on Steel Tubing and Wing Beams Taken from the Fokker D-VII
105. Covering Wing Gasoline Tanks in Martin Bomber
111. Comparative Test of Auxiliary Starting Devices for the Liberty Engine
115. Methods in Observation Practiced with Fifth Corps First American Army on the Fronts
117. Preliminary Choice of a Wing Section
118. Lubricating Oils—Specifications and Method for Testing.
119. Catalogue of Motion Picture Films and Lantern Slides
120. Observation, Selection, and Assignment.
126. Starting Torque on Liberty-Hispano-Suiza, and other Aviation Engines
127. Standard Engine Report of Hall-Scott, Type L-6, Rated at 200 H. P. at 1700 R. P. M.
128. Report on XBIA Cooling System Tests with 1,875 R. P. M. Propeller and 140 Sq. Ft. Radiator.
132. Performance Test of Roland D-VIB with 200 H. P. Benz Engine
138. Power Plant Laboratory Calibration of Six-cylinder 185-H. P. B. M. W. German Aviation Engine Prior to Test in the Altitude Chamber of the Bureau of Standards
143. Report on Performance and Design of Five Representative General Aviation Engines.
144. Report on Cooling System Test of Ordnance Model D with 300 H. P. Hispano-Suiza Engine and Nose Radiator at 168 Sq. Ft.
147. The Shift of the Angle of no lift on Propeller Airfoils.
148. Visualization of Air Flow.
150. Design and Stress Analysis of Wings for P. W. 2 Night Pursuit Type
151. Report on the Delco Automatic Generator Cut-out

152. Design of Standard Lugs
153. Performance Estimate of Spad 16-A with 236 H. P. Lorraine Deitrich Engine
154. Report on Special Airplane Wheel and Tire
158. Test of Stromberg Inverted Carburetor Model NA-L5 on the 12-cylinder Liberty Aviation Engine.
169. Efficiency of McCook Field Wind Tunnel
172. Structural Design of Cabane Struts for the PW-1 with R.A.F. 15 Tapered Wings.
173. Performance Test of Junker SL-6 with 185 H.P. B.M.W. Engine
175. Instructions for Installing 85-A Mixture Control in Zenith US-52 Carburetors
178. Report Giving Tables Showing the Freezing Points and Specific Gravity of Alcohol-Water Mixtures.
179. Report of Wind Tunnel Test of the Effect of Rake Angle on Suction in Exhaust Stubs.
180. Final Report Chief of Air Service, A.E.F. to Commander-in-Chief, Am. E.F.
181. Legal Questions Affecting Federal Control of the Air.
182. Report on Test of Sample of Crystal-on and Preliminary Report on Non-fog giving Treatment of Glass, Using Crystal-on, by the Navy Department.
183. Airplane Performance and Design Charts
184. The Use of Aerial Photographs in Topographic Mapping.
189. Test Report of Kellogg 600 Watt Reverse Current Relay
190. Test of Odier Portable Engine Starter
195. An Analysis of the Effect of Supercharging
196. Description of the McCook Field Wind Tunnel
197. Airfoil Data on American and British Airfoils
198. Report of Wind Tunnel Test on U. S.A. 27 Airfoil
199. Test of Standard Liberty Cylinder Mounted on a Universal Engine Crankcase

VOL. III.

201. Investigation of effect of zinc Plating on the Physical Properties of Streamline Wire
202. Velocity Determination in McCook Field Wind Tunnel
203. Report on Investigation of Dip Brazing with 80-20 Brass
206. Cooling System Flight Test of Loening M-8
210. Notes on Airplane Flight Endurance (1)
212. Experimental Reinforced Plywood Truss Ribs
213. Deflection of Beams of Non-Uniform Section
214. Operating Tests of Magnetically Operated Starting Switches
216. The use of Commercial Low Test Automobile Gasoline in Aviation Engines.
217. Experiments on the Design of Intake Bell for a Wind Tunnel.
223. Induction System Pressures in Liberty Twelve and 300 H. P. Hispano-Suiza Aeronautical Engines
224. Report of Wind Tunnel Test of U. S.A. 27-A, B, and C Airfoils
225. PW-1, U.S.A. 27 Wings
227. Operating Liberty "12" and Wright-Hispano 300 H.P. Engines on Automobile Gasoline—Types of Standard Service and Training Propellers
228. Report of Static Test of Wing Structure of U. S. GAX-1 (Type VI)
229. A Treatise on Radio Mechanics.
230. Investigation of Junker Biplane Wings
231. Report of the Medical Research Laboratory and School for Flight Surgeons for the Calendar Year, 1920.
232. Test of Airplane Engine Heater
233. Report of Cooling System Flight Test of the Fokker D-VII with Mercedes Engine.
236. Oxygen supply for Altitude Flights
237. Air Medical Service
240. Investigation of the Effect of Routing Wing Beams on Modulus of Rupture and other Strength Properties (FOR OFFICIAL USE ONLY)
243. Calibration of Carburetor Jet Flow.
244. Report of Wind Tunnel Test on U. S. A. Airfoils 30,31,32,33 and 34
248. Report of Wind Tunnel Test on R. A.F. 19, Springer No. 3, and Gottingen No. 244.
249. Report on Standard Test of the A. C. Spark Plugs.
252. Standard Engine Report on ABC "Dragonfly" Aviation Engine Rated at 320 H. P. at 1650 R. P. M.
254. Report of Static Test on the J. V. Martin Shock Absorbing Wheels with the Curtiss JN-4 Chassis.
256. Instructions for the Storage of Airplanes, Engines, Their Parts and Accessories
257. Instructions to Pilots for the Use of Mixture Controls.
259. Investigation of Crushing Strength of Spruce at Varying Angles of Grain.
260. The Economic Limit in Aspect Ratio of Single Bay Pursuit Biplanes
262. Tip-Vortices shown by the McCook Field Wing Tunnel.
263. Investigation of the effect of the Ratio of Diameter to Gage Thickness upon the Torsional Strength of Steel Tubing.
267. Report of Wind Tunnel Test on Gottingen No. 277 Aerofoil.
268. Supplementary Report on Experimental Reinforced Plywood Truss Ribs.
270. Report of Static Test on Engineering Division Messenger Airplane.
271. Report on Cooling System flight test of DH-4-C as furnished by the Packard Motor Car Company.
275. Investigation of methods of making Manganese Bronze Castings to meet Air Service Specification No. 11021.
276. Tests on Combined Loading of Wooden Struts.
277. Laboratory Test on Hartmann & Braun Electric Thermometer.
278. Report on Special Airplane Wheel and Tire (28 by 4 Straightside Tire, One-piece Rim).
280. Performance Test of Messenger Airplane Equipped with 3-Cylinder 60 H. P. Lawrence Engine.
281. The Sylphon Fuel Pump for Liberty "12" and Wright Model "H" Engines.
282. Fifty-Hour Endurance Flight Test of Delco Automatic Generator Cut-Out.
285. Performance Test of Morane Saulnier Type A. R. Airplane with two sets of Wings Equipped with 80 H. P. LeRhone Engine.
286. Performance Test of Spad 13 Equipped with 220 H. P. Wright Engine.
287. Performance Test of DH-4 with Liberty "12", 400 H. P. Liberty Engine Equipped as Two Seater Corps Observation Airplane.
288. Official Performance Test of Fokker Monoplane D-VIII Equipped with 180 H. P. Oberursel Engine.
289. Comparative Effect of Engine Operation in Flight of Outside and Inside Air Intakes.
290. Official Performance Test of Martin Bomber N. B. S. 1 Equipped with two 400 H. P. Liberty 12 Engines.
291. Instructions to Designers of Aircraft Carburetors.
292. Report on the Control of Carburetor Metering Characteristics by the Supplementary Admission of Air.
293. Comparative Flight Performance of Liberty Engines Equipped with 5.42 and 6.5 Compression Ratios.
294. Cooling System Test of the Curtiss JN-4 with Packard 1A-744 Engine Equipped with Side Radiators.
295. Report of Cause of Cracking of Alloy Steels During Dip Brazing.
297. Investigation of Dip Brazing with High Melting Point Brass.
298. Investigation of Some Solder for Aluminum—Part I.
299. Cooling System Test of LePere P-70 Equipped with Side Radiators.

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302. Fifty-Hour Endurance Flight Test of Auxiliary Starting Device (Buzzer Starter) for the Liberty Engine.
303. Discussion of Airplanes Tires and Wheels
304. Nomographic Column Charts.
308. Investigation of the Effect of Doped Fuels on Fuel System
311. The Determination of a Carburetor Setting for the Liberty Engine for Dirigible use.
312. Design of large Trussed Ribs
313. Reinforced Plywood Web Spars.
315. Determination of the Best Wing Loading for Single Seater Pursuit Airplanes.
317. Method for Estimating Power and Fuel Consumption of Normal Compression Aviation Engines in Flight at Various Altitudes.
318. Effect on Variation in Load Factor on Structural Weight of Wings.
320. Determination of Water in Gasoline as Received.
322. Report of Static Test of Ski for an SE-5 Airplane.
328. Report on Wing Tunnel Test on Aerofoils.
332. Study of Stress Analysis of the JL-6
334. Report on Wind Tunnel Test of USA-27-C Modified Aerofoil.
335. Investigation of Forged and Cast Brass
336. Effect of Fuel Head at Carburetor, on Brake Horsepower and Brake Specific Fuel Consumption.
337. The economical Use of Duralumin as a Substitute for steel in Compression.
339. Temperature Effect of Capillaries of Liquid and Vapor Pressure Thermometers.
*340. Statistics Compiled from Reports on Crashes in the U. S. Army Air Service During the Calendar Years 1918 to 1921, Inclusive, and

Results of Physical Examination for Flying During the Calendar Year 1920 and 1921.

341. Description of McCook Field Five Foot Wind Tunnel.
345. Report on Blower used in Tests of Air Cooled Cylinders.
346. Fuel Consumption Test of DH-4B with Liberty "12" Engine.
Type XV Equipped with Wright Model "E" Engine.
353. Reserve Bending Strength of Struts.
354. Variation in Performance of a Hispano-Suiza (Model E) Engine with Degree of Throttle Opening.
355. Report on Wind Tunnel Test of DH-4B Model.
356. Variation in Volumetric Efficiency of Engine with Valve Lift.
357. Report on Test of Bijur Ignition End Starter for Airplane Engines.
360. Report of Static Test of the Junker L-6 Monoplane.
363. Heat Treatment Bath Composed of Sodium Chloride, Sodium Carbonate, and Sodium Cyanide.
364. Adaptability of the Hyde Welding Process to Steel Engine Cylinder Construction.
367. Wind Tunnel Test of the Junker L-6 Monoplane.
368. Tests of Back Suction and Air Bleed Type Mixture Controls in Flight.
369. The Bellows (Sylphon) Fuel Pump for Liberty 12 and Wright Model H. Engines.
370. Test of a Zenith Carburetor, Model U.S. 52, Fitted with "Plain Tube" and Britton Type Discharge Nozzle.
372. Flight Test of Anti-Knock Injector.
373. Test of Curtiss Eight Cylinder Model OX-5 Engine Rated at 90 H. P. at 1400 Revolutions per minute.
374. Interior Corrosion of Steel Struts and its Prevention.

*For sale at 5c a copy by Superintendent of Public Documents, Washington, D. C.

Certain of the following documents are available by purchase from the Superintendent of Public Documents, Washington, D. C., at the price indicated. Remittances should be made to him by money order, coupon, express order or New York Draft. These are marked with an asterisk (*).

Number	Title	Price
959	Aerial Gunnery Practice at Depot and Service Schools, 1918	
960	Aerial Gunnery for Depot and Service Bombardment and Observation Squadron 1919	
827	Aerial Observation for Artillery, 1918	
733	Aerial Observation in Liaison with Artillery Addendum to Instructions for Use of (1917)	
740	Aerial Observation in Liaison with Artillery, Instructions for Use of (1917)	
664	Aerial Photography, 1917	
714	Aerial Photography Department in the Field, Bulletin of, 1917	
955	Aerial Sights and Sighting, 1919	
843	Aeroplane Flare, Mark I; and Release Mechanism, for Aeroplanes, 1918	
*935	Airplane Engine Carburetors, 1919	$.05
*998	Airplane Propeller, The, 1920	.45
966	Airplane Wire work, 1919	
913	Air Pressure, Gasoline Pressure and Oil Pressure Gages for Airplane Engines, 1919	
985	Airship and Balloon Gas Manual, Book I, 1919	.25
985	Airship and Balloon Gas Manual, Book II, 1919	.05
918	Air-Speed Meters for Aerial Navigation, 1919	
917	Altimeters for Aerial Navigation, 1919	
575	Anti-Air Craft Guns, Notes On, 1917	
*989	Anti-Air Craft Material	.20
*1004	Aviation Medicine in the A. E. F., 1920	.40
742	Barlow Heavy Drop Bomb and Release Mechanism Handbook, 1918	
597	Battle Maps, Instructions Concerning, 1917	
598	Battle Maps, Instructions Concerning; Annexes, 1917	
*986	Bomb Release Mechanism, Mark X, Service Handbook	
741	Bomb Sight, Mark I; Description & Instructions, 1918	
838	Bomb Sight, Mark I-A, 1918	
845	Browning Automatic Rifle, Model 1918—Handbook	
957	Camera Gun for Training in Aerial Gunnery, 1919	
991	Chanard Incendiary Bomb Service Handbook, 1919	
919	Clocks for Aerial Navigation, 1919	
*921	Compasses for Aerial Navigation, 1919	.10
418	Conventional Signs—U. S. Army, Maps 1918	
697	Co-operation Between Aircraft and Artillery During Recent Operations on 2nd Army Front, Notes on (1917)	
815	Corrector for the Anti-Aircraft Firing of Infantry Machine Guns, Provisional Instructions and Complementary Lecture on Organization and Use of, 1918	
*938	Curtiss Motor, The, 1919	.10
993	Demolition Drop Bomb, Mark I, 1920	
994	Demolition Drop Bomb, Mark III, 1920	
753	Drill Regulations for the 3" Anti-aircraft Gun, 1918	
717	Drop Bomb, Dummy, Mark I, Description and Instructions for Use of, 1917	
933	Electricity and Magnetism, 1919	
1046	Fabrics for U. S. Army Observation Balloons, 1920	
675	Field Service Manual for Ballon Companies, 1917	
634	Fire on Aeroplanes, Notes on, 1917	
840	Fragmentation Drop Bomb Mark II-A, 1919	
977	Fragmentation Drop Bomb Mark II-B, 1919	
*930	Gasoline Engines, 1919	.10
914	Gasoline Level Gage for Airplane Engines, 1919	
*965	General Information on Aerial Gunnery, 1919	.05
980	Hand Sewing of Material for the Covering of Airplane Surfaces, 1919	
724	High Capacity Drop Bombs, Mark I, II and III, 1917	
*942	Hispano-Suiza Motor, The	.15
777	Incendiary Drop Bombs, Mark I and II, Handbook, 1918	
920	Inclinometers for Aerial Navigation, 1919	
694	Identification of Aeroplanes, Notes on, 1917	
768	Infantry Aeroplane and the Infantry Balloon, The, 1917	
982	Information for Air Service Mechanics, 1919	
624	Information, Instructions on the Research and Study of 1917	
*936	Installation and Cranking of Airplane Engines	.10
664	Interpretation of Aeroplane Photographs, Notes on, 1917	
645	Landscape Sketching, 1917	
830	Liaison for All Arms, 1918	
639	Liaison in Battle, The Technique of, 1917	
625	Liaison Instructions for All Arms, 1917	
*941	Liberty Motor, The, 1919	.15
700	Listening Apparatus for Aircraft, Note On, 1917	
*931	Lubrication for Airplane Engines, 1919	.05
723	Machine Gun Drill Regulations, Provisional (1917)	
981	Machine Sewing for Air Service Mechanics, 1919	
*934	Magnetos for Gasoline Engines, 1919	
881	Manual for Balloon Cutters, 1918	
666	Means of Communication between Aeroplanes and the Ground, 1917	
706	Meteorology, 1917	
*945	New Types of American Motors, 1919	.05
*946	New Types of Foreign Motors, 1919	.10
924	Oxygen Control Regulator for Airplanes, 1919	
*954	Parachute Manual for Balloons, 1919	.10
923	Performance Testing Instruments for Airplanes, 1919	
961	Pilots' School Ground Training for Aerial Gunnery, 1919	
*939	Principal Parts of Airplane Engines, 1919	.05
816	Provisional Drill Regulations. Anti-Aircraft 75 mm. Gun, Model 1915, 1918	
*615	Provisional Machine Gun Firing Manual, 1917	.35
915	Radiator Thermometer for Airplane Engines	
630	Recent Operations. Notes on, 1917	
*925	Repair and Calibration of Airplane Instruments	.05
624	Research and Study of Information, Instructions on, 1917	
*944	Rotary Motors	.15
500	Signal Book, U. S. Army, 1916	
704	Sound Liaison, 1917	
839	Smoke Torch, Mark I—Description and Instructions for Use of, 1918	
963	Spad Mechanical Timing Gear for Aerial Fire Control, 1919	

AERIAL AGE

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THE National Aeronautic Association of the U. S. A. has recently announced in the public press that the Association has decided to call an International Conference of scientists, technical men and aircraft manufacturers for the purpose of reaching a better international understanding in the matter of research work and the engineering end of aeronautics which, in the opinion of the Association, is most essential to the future progress of aeronautics. Also it is the announced intention of the Association to raise the question of Standardization and to promote a spirit of cordial coöperation in the progress of aeronautics among scientists, technical men and manufacturers both in the United States and in Europe.

We are more than pleased, we are proud of this announcement made by the National Aeronautic Association of the U. S. A. because Aerial Age has been the first aeronautical magazine in the world that has raised the point and during the last three years has conducted an active campaign in favor of Standardization and international coöperation in aeronautics.

The appointment of William Knight, associate editor of Aerial Age to Vice-Chairman of the Committees on Foreign, Industrial Relations and Scientific Research of the National Aeronautic Association and the announcement by the Association that our colleague will be actively in charge of the arrangements for the International Congress is a guaranty of the sincere efforts that the Association will make in order to obtain the desired results.

We wish to pledge once more our individual support to the splendid work that the National Aeronautic Association of the U. S. A. is doing and we are glad to see it take a bold stand on the matter of International Coöperation in Aeronuatics which is absolutely essential to the progress of commercial aviation.

We want to see America first in the air but we also want to see America be the first nation to recognize that aeronautics is primarily the carrier of the commerce of the world and that the basis of International Commerce is arrived at through international agreements between nations on all matter of common interest. International coöperation in aeronautics is a first step, and a long one, in the right path.

THE matter of the physical requirements that must be possessed by pilots before they are considered fit to fly was recognized as early as 1919 to be one that must be settled through international conferences and agreements. In fact it was recommended by the medical commission attached to the Peace Conference that an International Medical Congress be held at Oxford in 1920 in order to reach an international agreement on the matter of licensing pilots in so far as their physical ability to fly is concerned.

The Oxford congress did not take place in 1920. In 1921 at the first International Congress of Aerial Navigation this point was discussed once more but nothing was done because it was expected that the Oxford Congress recommended by the Peace Conference would take place in 1922.

We are now in 1923 and nothing has been done yet, in spite of the fact that everybody recognizes the fact that it would be absurd to have different medical standards adopted by various nations in this matter which would make possible for a pilot who is considered physically fit to fly in the United States or in England to be considered physically unfit to fly in Canada or France.

The matter of physical ability or disability of pilots to fly, especially in so far as their eyes and ears are concerned, and the criticism which must be adopted for judging about this are of the greatest importance both from the point of view of the safety of passengers and from the point of view of insurance companies.

The general impression in Europe, as it was evident at the first International Congress of aerial navigation in Paris was that in this country we are inclined to give less importance to this matter than is the case in Europe. We were not represented at that congress and we could not be heard.

It seems to us that it would be very detrimental to our own interests if we should fail to coöperate with other nations in this matter and we believe that the sooner we start realizing that aeronautics has international problems in which we are directly and most vitally interested, the better it will be for us in the long run.

A DICTIONARY of aeronautical terms in four or five languages is one of the most needed books in an aeronautical library now-a-days. A number of small size dictionaries serving more or less incompletely the present needs of a student of aeronautics who wishes to follow what is being published in the aeronautical press outside his own country were developed during the war by the technical services of the allied nations. More work in this direction has been done by the National Advisory Committee for Aeronautics in this country and by the Royal Aeronautical Society in London which have both issued much needed standard definitions of aeronautical terms used in the English language. A good dictionary giving the name of the same thing in English, French, German, Italian and Spanish, however does not exist at the present time and would be a mighty useful book to edit.

Could not this book be edited by either the National Advisory Committee for Aeronautics, who already has a large amount of material on hand for such a book, or else by the National Aeronautic Association of the U. S. A? The coöperation of governmental services and aircraft manufacturers of all nations to the successful edition of a really good aeronautical dictionary could not fail and such a book would be of a very great help to the development of aeronuatical knowledge.

IN FRANCE the organization of aeronautical services for the transportation of sick and wounded through the air in flying ambulances has been greatly developed and perfected during the past year, especially as in the French Colonies where this method of rapid transportation has been of great help in checking the spreading of contagious diseases and in saving a good many lives of French soldiers and natives which would have been otherwise lost.

We have not done much in this country for properly organizing this service in connection with the work of our Red Cross and our sanitary corps. The money would be better spent in military aviation than in perfecting and developing the design and the use of aerial ambulances which could render valuable services in time of peace (especially so in some sections of the country which are not thickly populated), and which in time of war would be an almost invaluable means of saving some precious lives.

If our Red Cross and the American Relief Commission in Russia had been equipped with aircraft, the usefulness of the splendid work performed by them would have been greatly increased.

It is time, we believe, that we start using aircraft as a means for saving lives after the extensive use that we have made of them in destroying lives.

IT IS generally agreed by everybody that the success of flying is closely related to a successful establishment of meteorological services which will supply enough information to the flying fields to enable them to give proper instruction and information to pilots before leaving the aerodrome.

This is essential but there is something now that we must consider in connection with the laws and regulations that will be adopted for licensing pilots. A pilot must not only be able to carry out the instructions that he received before leaving the ground regarding the kind of weather that he will find along the route, he must also have a sufficient elementary knowledge of meteorology to enable him to recognize atmospheric conditions arising during the flight which were not anticipated at the time when he left the aerodrome and know in time what to do.

It will not be necessary to require from pilots an expert knowledge of meteorology but a light baggage of knowledge in this most important phase of aeronautics will not be out of place on a commercial craft where the lives of passengers and the security of valuable property is mostly in the hands of the pilot.

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Airscape of Grant Memorial, Washington, D. C.

Howard E. Coffin, Pres. B. H. Mulvihill, V. Pres. B. F. Castle, Treas. John B. Coleman, Rec. Sec.

Official Bulletin of National Aeronautic Association of U. S. A.

Col. H. E. Hartney, General Manager Cable Address, Nataero
National Headquarters, 26 Jackson Place, Washington, D. C.

The National Aeronautic Association of U.S.A. assumes responsibility for the statements under this heading

THERE seems to be some misunderstanding throughout the country in regard to the connection between the National Aeronautic Association of U. S. A. and the Federation Aeronautique Internationale, with respect to the authentication of records by the Contest Committee of the National Aeronautic Association covering record performances in the United States.

The Press of the country sent out statements concerning the recent attempt by the Army Air Service to secure the world's record in aeronautical performance at Dayton, printing therein that French officials were at Dayton to time the contestants and that the F. A. I. was in control, together with other misleading statements, ignoring the N. A. A. altogether.

The truth of the matter is contained in the following:

"The National Aeronautic Association of U. S. A. is now the sole American representative of the Federation Aeronautique Internationale, and in the future, all contests, flights for records, sports and meets in this country, in order to be homologated for purposes of world's records, must be under the rules and regulations of the Association by virtue of its affiliation with the F. A. I.

"Under the F. A. I., the Association appoints committees responsible for the enforcement of the rules of the Federation, issues licenses to pilots, and for meets and races; sanctions meets, races and sports; classifies aircraft; examines and passes upon regulations and programs for contests; ratifies results; may bar suspended persons from participating in events; passes upon the advisibility of events; designates approval of officials and appoints timekeepers; gives official ratification to records and imposes penalities; pronounces the homologation of international events, and gives final decisions as to international records."

Confirming the above, Colonel Frank P. Lahm, Chairman of the Contest Committee of the N. A. A. has sent to the Press Associations and the Editors of the newspapers throughout the country the following communication:

"The National Aeronautic Association of the U. S. A. is the American member and sole representative in the United States of the confederation of world aeronautical bodies—the Federation Aeronautique Internationale, whose headquarters is in Paris, France.

"As sole representative the National Aeronautic Association of U. S. A. with headquarters in Washington, D. C. sanctions all official aeronautical race events in this country. Its Contest Committee appoints all official starters, timers and observers.

"No officials from France or any other country of the Federation Aeronautique Internationale officiate at any race meet in the United States. The F. A. I. statutes are observed to the letter at all sanctioned American contests.

"The authentication of a record by the Contest Committee of the National Aeronautic Association of U. S. A. is accepted by all clubs and federations affiliated with the F. A. I. as final".

At Dayton, in control of the speed trials at Wilbur Wright Field, now being carried out by the Army Air Service, the officials appointed by the N. A. A. are all Americans and are as follows:

Chief Timer: Mr. Odis A. Porter, Stand No. 1

Ass't Timer: Mr. L. Luzern Custer, Stand No. 2.

Directing Official: Mr. Orville Wright of the Contest Committee of the National Aeronautic Association as Official Observer at Station No. I.

Mr. Lorin Wright of the Contest Committee of the National Aeronautic Association as Assistant Official Observer at Station No. 2.

Mr. Charles M. Kelso: acted as observer at the 500-meter point before station No. I.

Mr. George B. Smith: acted as observer at the 500-meter point before station No. 2.

These officials were in charge of the flights of Lieut. R. A. Maughan and Lieut. L. B. Maitland, when Maitland broke the world's record for one kilometer course, establishing an average speed of 239.95 miles per hour.

It is hoped that this explanation will be sufficient to set at rest for all time the question of who is the authority in this country for authenticating official records of aeronautical performance.

The N. A. A.'s Membership Campaign.

The membership campaign now being conducted by the Association is in full swing and progressing most satisfactorily. There is an awakening throughout the entire country to the fact that the Association's motto "America First in the Air" is a serious mark to which Americans must try to attain. In consequence of this the membership campaign is rolling up impetus which beyond question, will exceed the mark set for June first, 50,000 members. Reports from the field indicate that the membership will probably reach 100,000 by that time.

Below is a supplementary list of the officials of the Association and the District chairmen, a list which is being augmented daily.

FIRST DISTRICT

The District Chairman and treasurer is Col. Edgar S. Gorrell, President of the Boston Marmon Company. The Executive Secretary is Mr. Roger Merrill of Boston.

State Advisory Committees:

Maine: W. H. Gannett, Editor and Publisher, Chairman and Ralph Webber, Secretary, both of Augusta, Maine.

New Hampshire: Major Frank Knox, Chairman, and Guy L. Foster, Secretary, of Manchester, N. H.

Rhode Island: Governor Wm. S. Flynn, Chairman, Providence, R. I.

Vermont: Governor Proctor is Chairman of the Advisory Committee and Col. Ernest W. Gibson of Brattleboro is Chairman of the Campaign Committee. Mr. Frederick Harris of Brattleboro is to form a chapter there.

SECOND DISTRICT

The Executive Secretary is Mr. Evan J. David of the John Price Jones Corporation, New York City. The District Advisory Committee is made up of the following men: Howard S. Borden, Milton F. Davis, John D. Larkin, Charles E. Merrill and Palmer Pierce, all of New York.

THIRD DISTRICT

The Executive Secretary is Mr. R. P. Strine of Phila.

FOURTH DISTRICT

The District Chairman is Mr. Charles A. Moffett, President of the Gulf States Steel Company of Birmingham. The Executive Secretary is Mr. L. L. Boyer, of Birmingham.

Georgia: The Chairman of the State Membership Campaign Committee is Mr. L. W. Roberts, Jr., and the Vice Chairman Mr. J. E. Addicks, both of Atlanta.

Mississippi: The Chairman of the Advisory Committee is Governor Lee M. Russell of Jackson.

So. Carolina: The Chairman of the Advisory Committee is Governor McLeod of Columbia.

Tennessee: The Chairman of the Advisory Committee is Governor Peay.

FIFTH DISTRICT

The District Chairman is Hon. Newton D. Baker of Cleveland, Ohio, and the Executive Secretary is Mr. Carl B. Squier of Cleveland.

Ohio: The Chairman of the Membership Campaign Committee is Mr. Frederick B. Patterson of the National Cash Register Company with Mr. John Ahlers as Assistant. Mr. A. W. Henn is also on this Committee.

Indiana: Mr. F. E. Moskovics Vice President of the Marmon Company is the Chairman of the Membership Campaign Committee in Indianapolis.

SIXTH DISTRICT

The District Chairman is Mr. Samuel M. Felton, President of the Chicago and Great Western Railway, and Mr. Thomas L. Munger is the Executive Secretary. The Treasurer is Mr. Frank Whiting also of Chicago.

Michigan:

Detroit: The Membership Committee in Detroit is composed of the following men:—E. A. Loveley, Charles Bush, William F. Metgerm, Col. W. H. Alden, D. S. Stearns, S. W. Utley, George Holley, W. A. Mara, Col. J. G. Vincent and Col. Edgar Goodloe.

Bay City: The Chairman of the Membership Committee is Mr. L. P. Koepfgen.

Wisconsin: The Chairman of the Membership Committee at Milwaukee is Mr. Stephen J. McMahon, with Mr. F. A. Vaughn also on the Committee.

SEVENTH DISTRICT

The District Chairman is Mr. Joseph Pulitzer of St. Louis, Mo. and Mr. Roy B. Fisher is Executive Secretary from Davenport, Iowa.

Minnesota: Governor J. A. O. Preus of St. Paul is Chairman of the Advisory Committee.

Kansas: Governor Jonathan M. Davis

(*Concluded on page* 248)

THE NEWS of THE MONTH

A Memorial to the Wright Brothers

Dayton, Ohio, the home town of the inventors of the airplane, is getting together a fund for the erection of a Wright Memorial, the proposed site of which is on the spot at Simms' Station where the first plane was built. This ground is also incorporated as part of the plot presented to the United States Government by Dayton citizens for use in building a new home for the Engineering Division of the Air Service. Should Congress accept this location the memorial will probably be constructed as an artistic bit of architecture near the entrance to the Government Station.

New York Chapter N. A. A. Organized

A New York chapter of the National Aeronautic Association of the United States was formed April 5 at a meeting in the Hotel Biltmore and Charles E. Lucke, a consulting engineer and Professor of Mechanical Engineering at Columbia University, was elected President. The purpose of the chapter is the development of commercial aviation and the creation of interest among the people of the country in aviation, so that America may be made first in the air.

Other officers elected were David W. Magowan, Vice President; Archibald Black, Secretary; G. Douglas Wardrop, Treasurer.

National Balloon Race at Indianapolis

Indianapolis has been awarded the national elimination balloon race in a keen contest with Detroit, Milwaukee and San Antonio, it was announced at headquarters of the National Aeronautic Association. The contest will be held between June 9, and July 4, and according to present arrangements, the motor speedway at Indianapolis will be utilized as a balloon field.

The entry of fourteen American balloons is assured, out of which the first, second and third in the race will be the American entries in the International balloon race at Brussels, Belgium, Sept. 23, for the James Gordon Bennett trophy. The American race will be held under the auspices of the National Aeronautic Association and the Aero Club of Indianapolis, assisted by the Indianapolis Chamber of Commerce which has guaranteed the expenditures in connection with the meet.

The Army and Navy will probably be represented by four entries and four new balloonists have filed entries with B. Russell Shaw, Executive Chairman of the contest Committee of the N. A. A. Some revolutionary ideas in balloons are promised by new entrants and there is indication that the elimination contest will provide sensational sport. Indianapolis will put up a purse of $3,000 for division among the contestants. Interests in future aerial competitions will be stimulated as a result of the membership campaign of the National Aeronautic Association, which has made provision for an annual fund of $75,000 for prize awards if the quota of 50,000 members is attained throughout the country. With favorable wind and weather at Indianapolis it is confidently expected that the American record of 1,172 miles for free balloon flight, held by Allan Hawley of New York, will be shattered.

Official starters, timers and observers for the elimination race will be appointed by the National Aeronautic Association, which must authenticate the records for acceptance by the Federation Aeronautique Internationale, of which the association is the sole representative in America.

Airport for Chicago

A municipal airdrome is at last an assured fact for the city of Chicago. During the season of 1922 negotiations were begun to secure such a field which would be open to all pilots both local and visitors. A tract of ground consisting of 80 acres (one half mile long and one quarter mile wide) was leased from the city. It was so late in the Autumn that nothing was done until recently toward putting the field in shape for landing.

At present a three ship tent hangar is being erected which was secured from the government and an underground gasoline tank and service pump have already been installed. By April 1st, there will be a small shop, culverts, driveways, stock room, etc., in place ready to service visitors and local flyers.

This field is situated at the Southwest side of the city, on the Northwest corner of 63rd Street and Cicero Ave. It is about 25 minutes from the down town district by Auto and has street cars on both the South and East side which takes one to the city in 45 minutes. There are lunch rooms and other stores adjacent to the field where the visitor may eat and secure the necessary things he may want.

The field is sod and has drainage ditches on two sides which assures safe landings most of the season. Cinder runways will also be established as fast as possible. Also extra hangar space will be put up during the season. This field will be operated for anyone who wishes to use it and the army, navy and mail planes will not be charged for landing or storage.

Several of the local companies have indicated that they will use this field. The Diggins School, The James Levy Company, Chas. Patterson, and others. The two first named companies have affiliated this year and are entering upon their fifth year of operation. They will carry on instruction, passenger flights, photography, sales, cross country, and a general Aviation Business. This is without doubt one of the biggest affiliations in the industry in this section.

The National Airplane Meet

A unique aerial race, the first of its character staged, will pit a specially built dirigible balloon against an airplane at the national airplane race meet at St. Louis. The dirigible is designed to make a speed of eighty miles an hour and the contending airplane will be a JN-4, one of the most popular training machines used in this country. Aeronautical sharps are looking for a close race with something of a comedy element in it because of the "fat and lean" contrast between the two aircrafts. The event, however, is planned as a serious test of Army equipment to bring out features adaptable to the air defense of the country in time of war.

Led by Acting Mayor Aloe, the St. Louis airplane race committee with the cooperation of the St. Louis Flying Club, has all local business interests united in working together to make this the greatest meet in the history of aviation. It was announced at headquarters of the National Aeronautic Association today that manufacturers of aircraft and accessories are already offering special prizes for particular performances by the contestants and that the indications are for the greatest collection of awards for contenders ever known at an aviation exhibition.

St. Louis is making a special campaign to enroll every man and woman in the city in the National Aeronautic Association in order that the race meeting days, October 1, 2 and 3, which fall in the week of the annual carnival of the Veiled Prophet, with its great parades, ball and banquet, will add to the alluring attractions of that autumn festival.

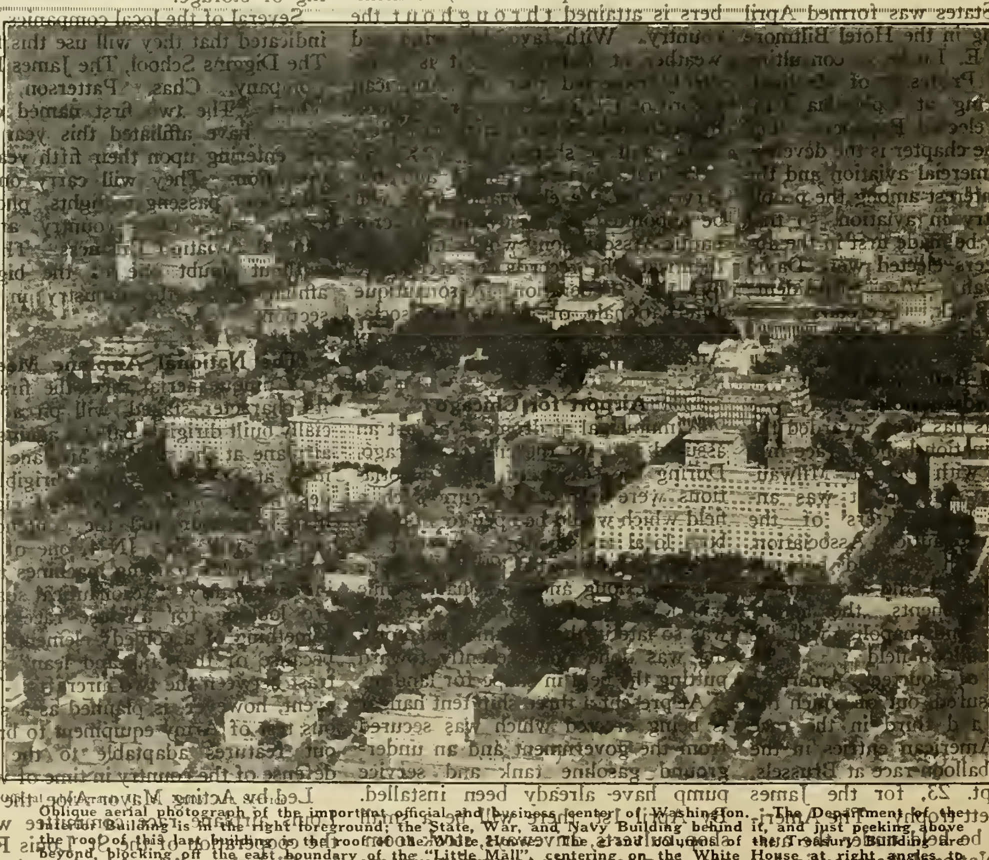
Plans are afoot to make an intensive canvass of St. Louis, beginning May 14, with leadership in numbers in the Association over every city in the country the goal.

Acting Mayor Aloe is moving every influence to present at the annual meeting of the National Aeronautic Association, which will bring hundreds of the leaders in American aeronautics together during the race meet, a solid phalanx of members as the largest reception committee on record. The appeal to St. Louisans to pledge themselves to membership during the country-wide campaign of the Association that aims at a mark of 50,000, is three fold, and the acting Mayor is said to be confident that his city will do the unexpected at the race meet, the carnival and the convention.

Governor Hyde of Missouri, who has under consideration accepting the chairmanship of his State's advisory committee of the National Aeronautic Association for the campaign, is expected to be present during the races and extend a welcome at the convention.

Missouri is keenly awake to the need of aeronautical advancement that will place unshakably America first in the air. This is the slogan for the membership canvass which, enthusiastic workers in the field declare, is bound to result in bringing 100,000 into this patriotic movement by June 1. The extensive agricultural activities of Missouri are making an active interest in the utility of aeronautics and there is a growing demand for aerial forest patrol, dusting and spraying of trees, the conservation of crops and scientific research which will enhance the products of Missouri soil.

As it is one of the principal functions of the National Aeronautic Association to inform the people of the attainments in the air that benefit commerce, finance and agriculture, the endorsement of its work in Missouri is already shown convincingly by the enthusiasm with which it greeted the award of the national airplane races to St. Louis in the keen competition with many other cities. All Missouri is a unit with every section of the country in the purpose to work within the National Association to maintain the economic leadership of the country and the national independence through a wise provision for the air defense of the United States and its possessions.



Oblique aerial photograph of the important official and business center of Washington. The Department of the Interior Building is in the right foreground; the State, War, and Navy Building behind it, and just peeking above the roof of this last building is the roof of the White House. The grand columns of the Treasury Building are beyond, blocking off the east boundary of the "Little Mall", centering on the White House at right angles to the Grand Mall between the Capitol and the Lincoln Memorial.

THE AIRCRAFT TRADE REVIEW

New Loening Air Line

A group of prominent citizens of Newport have raised a subsidy for the operation of a fast and properly equipped Air Line which has been awarded to the NEW YORK-NEWPORT AIR SERVICE, INC., a new company which has just been formed for this purpose.

This group includes many prominent men and women, among whom are Robert Goelet, Arthur Curtiss James, James B. Duke, Henry Walters, Oliver Gould Jennings, Henry A. C. Taylor, Stewart Duncan H. Barton Jacobs, Marion Eppley, George Henry Warren, Forsythe Wickes, Ogden Hammond, Clarence Dolan, James S. Cushman, Mrs. Vanderbilt, Mrs. Nathaniel Thayer, Mrs. O. H. P. Belmont, Mrs. Horace Gallatin, Mrs. James B. Haggin, Mrs. Charles F. Hoffman, Mrs. Hugh Auchincloss, Mrs. Frederick Tearson, Grafton Cushing, John Aspegren, J. F. A. Clark, Francis Roche, George Widener, T. Townsend Burden, Lawrence L. Gillespie, Clarence Pell, Oscar Cooper, Edson Bradley, William Fahnestock, Conde Nast, Paul Fuller, Bradford Norman, R. G. Shaw, T. Suffern Tailer, and Vincent Astor. Mr. T. Suffern Tailer and Mr. Astor were appointed a committee to develop this service.

The manner in which the subsidy raised by citizens of Newport has actually resulted in the organization of a new company with new equipment is typical of the manner in which subsidies have helped commercial aviation in Europe, where the governments of France, England, Holland and Germany grant large sums of money outright to aircraft operators in order to enable them to meet the high expense of a properly maintained Air Service. While efforts have been made in Congress to point out the desirability of this policy for years and obtain some kind of legislature therefore, it has remained for a group of public spirited citizens on their own initiative to do it themselves.

The directors and incorporators of the new Air Line are Vincent Astor, Grover Loening, Edwin de T. Bechtel, Charles L. Lawrence, Roger M. Poor, Albert Palmer Loening, and John Carrington Yates, all of New York. The fast Loening Air Yacht, which holds several world's records, is the type of aeroplane that will be used. This is the same type as was used so extensively last Summer by Mr. Astor in his flying between New York and Newport and the North Shore, and also by Mr. Harold Vanderbilt. The machines to be used on this line represent the highest development of new commercial aircraft in America, and the New York-Newport Air Service is the first Air Line in this country to use in its work brand new machines of the most modern design, and having so high a speed that real service in time saving is rendered. Heretofore Air Line operators in this country have been more or less forced to use old war types of aeroplanes disposed of by the government at low prices. The new machines are very much faster and more efficient so that the trip from New York to Newport may be made in an hour and a half, whereas it takes six hours by train.

The New Air Line is to use the same type of motor so successfully used by the trans-continental Air Mail Service and through the courtesy of the Post Office Department and Mr. J. E. Whitbeck, Superintendent of the Eastern Division of the Air Mail, the personnel and maintenance system on the motors and planes is being developed from and modeled after the vast experience of the Air Mail experts. Mr. Grover Loening, who will be in charge of the operating, has just returned from an extensive study of European Air Lines and flew over 2,000 miles on the various machines over there. The latest practices on the proper operation of air transportation will be applied on the New York-Newport Air Service and every possible safety precaution that has been developed to a successful and reliable point will, of course, be used.

Sikorsky Aero Corp. Organized

The Sikorsky Aero Engineering Corporation was chartered on March 5th, 192[illegible], by the Secretary of the State of New York, with a capitalization of $200,000.

The purpose of the Corporation is to build, sell and in general exploit the aeroplanes of Mr. I. I. Sikorsky's system.

Mr. I. I. Sikorsky, who is President of the Corporation, is the famous Russian constructor of the first multi-motored aeroplane in the World, as well as the first successful large aeroplane. The other officers of the Corporation are:—Mr. W. A. Bary, Treasurer, Mr. L. A. Shoumatoff, Secretary.

The offices of the Corporation are temporarily located at 114 East 25th Street, New York City.

Gallaudet Plant on Full Time

The Gallaudet Aircraft Corporation at East Greenwich, R. I., is now operating on full time, employing 215 hands.

U. S. Airport Facilities

The Aeronautical Chamber of Commerce with the able assistance of the federal air services computed the airports in this country as follows:—Government 123; Commercial 184; Municipal 160; Seaplane 110; undeveloped facilities 1756—making a total of established and possible airports, 2,333.

Charles F. Redden, Charles S. Jones and Archibald Black have been appointed a committee on air terminal to advise and assist individuals, corporations and others in establishing land and water terminal facilities.

Italy to Subsidize Aircraft Industry

Dispatches from Rome indicate that Premier Mussolini's plans for establishing the air force on a firm foundation include the subsidizing of the industry and insuring a continuous output of planes and motors along with advanced engineering research. The air service has been made co-equal with the Army and Navy.

Barber & Baldwin, Inc.

Barber & Baldwin, Inc., have issued a very interesting booklet detailing their activities and the purposes for which the firm was organized. Their office is at 30 East 42nd Street, New York. Mr. Horatio Barber, senior member of the firm, will be remembered as the author of "The Airplane Speaks," and one who has been identified with aviation the last fourteen years. With Mr. Barber the directors include Robert H. Baldwin and J. Brookes Parker, assisted by Archibald Black, the aeronautical engineer. The firm is listed as aeronautical consultants, underwriters and fiscal agents.

ARMY and NAVY AERONAUTICS

New Navy Air Engine Runs for 573 Hours

Completion of a record-breaking test of a new airplane engine was announced April 7 by the Navy Department. For 573 hours the power plant, known as a Wright model E-4, ran without a stop with the throttle wide open. Data accumulated during the run indicated "a saving of 90 per cent. in the operating cost of aircraft engines of this type."

An indication of the remarkable endurance of the new engine will be given, engineers said, by comparison with the types used in the World War, when 100 hours was considered a long run.

The engine was built by the Wright Aeronautical Corporation of Paterson, N. J. During the test it would have covered, at the usual cruising speed maintained by the navy at sea, approximately 60,000 miles, or two and a half times around the world at the equator, in a period of a little more than three weeks, according to Rear Admiral William A. Moffett, Chief of the Bureau of Aeronautics.

To give a further popular picture of the performance of the Wright E-4, Admiral Moffett compared its record to that of the average better grade high-power automobile, which, he said, usually traveled about 6,500 miles annually. At the rate theoretically flown by the new engine, it could have driven the automobile for approximately nine years at 100 miles an hour.

"The improvement is the result of intensive work for more than a year in the engineering section of the Bureau of Aeronautics," Admiral Moffett said, adding that a new standard had been set up, both in regard to operating cost and to dependability.

Army Aviators to Take Up Gliding

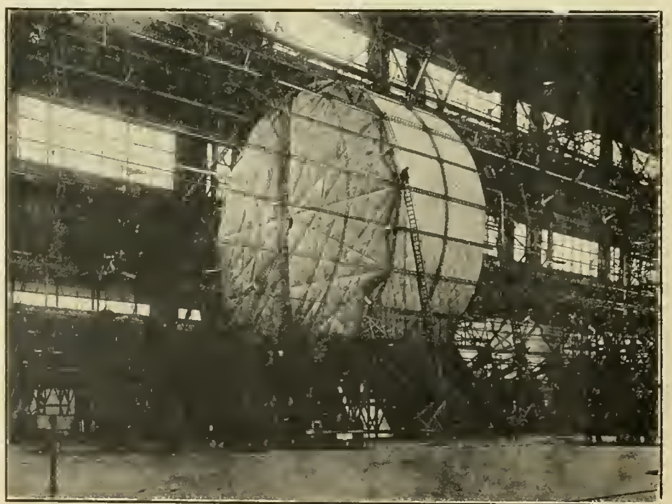
The Army Air Service will devote its attention for some time to come to the development of the glider, or motorless airplane. This was announced at the War Department where it was said the department had become convinced that the development of interest by civilians in the glider would prove invaluable to the Government in training men for service as emergency airplane pilots.

Several tests of the GL-2, a motorless airplane, have recently been conducted at McCook Field at Dayton, and the result of those experiments, it is stated, were most satisfactory. In one flight, the machine covered 150 feet, and in another it exceeded 300 feet. The wind velocity during the tests was two to fifteen miles an hour.

A recent ingenious development of the glider at McCook Field is its use as a target for the practice of anti-aircraft gunnery. The so-called "target glider," as developed by the Air Service Engineering Division, is a smaller edition of the regular glider and is fastened to the top wing of an airplane. On being released the target glider gradually descends to the ground at a speed of about thirty miles an hour, affording a realistic target for anti-aircraft and airplane guns.

The "target glider" has a wing span of twelve feet six inches, an area of eighteen square feet and weighs twenty-three pounds. This size was decided upon as presenting as much surface to the gunner as the vital spot of a full-sized airplane. The speed at which the glider descends may be regulated by change of weight or manipulation of tail surfaces. It can even be adjusted before release to loop or spiral.

The experiment, according to army officers, showed that up to speeds reached in the test flight, fluttering of the glider did not occur; that even when released with insufficient incidence it could be made to leave the airplane without danger of fouling; that a greater altitude was necessary in order to give it a chance to recover its normal glide; that the release latch was satisfactory, and that about five inches should be cut from the glider tail to assure sufficient incidence for a prompt get-away when released.



First gas cell in place and under test in the giant Navy rigid airships now being built at Lakehurst, N. J.
© Official photograph U. S. Navy

Building Dirigible to Carry 12 Planes

The giant semi-rigid airship now being constructed at Akron for the Army Air Service, is to be used as an airplane carrier. Plans are practically completed, it is stated, for equipping the great dirigible with twelve small fighting planes, which cannot only be picked up by the airship while both are in flight, but which also can "take off" from the moving airship.

Experiments just completed at Mitchell Field, Mineola, L. I., have proved incontrovertibly that airships can be used as airplane carriers, Air Service officials state. While the general type of apparatus for picking up the planes and for launching them has practically been determined, it is possible that further experimentation will result in slight modification of their apparatus.

In the experiments at Mineola, which till now have been kept secret, a large ring was placed on the upper wing of the airplane, and a hook of considerable size was suspended from the basket of the airship. After the airship was in full flight, the airplane pilot flew under the basket of the airship, regulating his speed to that of the dirigible. Since the equality of speed gave practically the same effect as if both machines were standing still, the picking up of the airplane was accomplished quite easily. No mishap of any character was experienced during the experiments, army fliers assert.

The great airship which will be used as an airplane carrier, is one of three contracted for by the War Department with the Goodyear Tire & Rubber Company. One of these, the TC-1, was recently completed, and is now undergoing trial flights, following which she will make a cross country flight to Niagara Falls and return.

Though the TC-1 is the largest semi-rigid airship ever built in America, she is scarcely one-third the size of the ship which will be used as a carrier. The TC-1 has an envelope capacity of 200,600 cubic feet, while the new ship will have a gas capacity of 750,000 cubic feet and will be the biggest semi-rigid in the world.

The new airship, which will probably be called the TC-2, will be completed about Sept. 1. In size she will be somewhat smaller than the ill-fated "Roma," which was burned at Hampton Roads, Va., more than a year ago with great loss of life. In lifting capacity, however, she will be superior to the Roma and, according to air officers, she will be much safer. The board of inquiry which investigated the Roma disaster found that the great loss of life was due primarily to the conflagration resulting from the ignition of the hydrogen gas which inflated the envelope. The new ship will be so constructed as to permit of inflation with helium, which is non-inflammable, and army experts assert advantage has also been taken by the engineers of the lessons learned from the Roma disaster in avoiding certain weaknesses of construction. The new ship also is expected to have greater speed and manoeuvering ability than the Roma.

The Army Air Service for more than a year has been studying the problem of utilizing airships as airplane carriers. As a matter of fact, it was the expectation that experiments along this line might be conducted that the army decided to purchase the Roma from the Italian Government. Tentative plans for such experiments already had been worked out and would doubtless have been put into effect but for the disaster to the "Roma."

Since that time still further study has been made of the problem and activities of other nations in this respect have been investigated with the result that plans are now practically complete.

Under the naval treaty adopted at the Washington arms conference, an absolute limitation is placed on the number and tonnage of naval airplane carriers which any of the signatory powers may have.

Two New Army Records

American airplane speed records for 500 kilometer (310 miles) and 1,000 kilometers (620 miles) were authenticated by the contest committee of the National Aeronautic Association April 7, both made by Army aviators. The 500 kilometer speed record was made by Lieut. Alex Pearson, flying a Verville-Sperry plane with Wright motor, who maintained a maximum speed of 167.8 miles an hour. This performance exceeded the world record of Boussoutrot of France, made last year, of 86 miles an hour by more than 81 miles, speed over the 310 mile course, also the mark made by Lieutenants Batelier and Carrier at Etampes, France, March 30, of 115 miles an hour by more than 52 miles.

The 1,000 kilometer record was set up at 127.42 miles an hour by Lieutenants H. R. Harris and R. Lockwood, flying a DH-4 plane with a Liberty motor, exceeding the French record of Boussoutrot and Bernhard of 61.68 miles an hour by more than 66 miles speed, and the mark of Batelier and Carrier made March 30 at Etampes, 93 miles, by more than 34 miles speed an hour.

The two record flights were made during trials of six Army airplanes over the measured course at McCook field, Dayton, Ohio, on March 29. Orville Wright was the official representative of the National Aeronautic Association, and Otis Porter of Indianapolis the official timer. These records have been filed with the Federation Aeronautique Internationale at Paris, which is solely represented in America by the National Aeronautic Association.

Radio Towers at Fairfield

The Army Air Service has completed two steel radio towers, 160 feet high and 475 feet apart at the Fairfield Air Intermediate Depot. These are to be illuminated at night.

The T-C-1 Successfully Tested

Uncle Sam's latest leviathan of the air, the United States Army training airship C-type-1, the largest non-rigid ship ever built in America began her trial flights March 16 at Goodyear Akron Air Station, under the supervision of a crew of officers and men from Scott Field, Belleville, Ill.

The T-C-1 as she is officially known, is the first of three ships of this type being built for the army by the Goodyear Tire and Rubber Co. of Akron, Ohio, and will be used as a training ship for airship pilots in preparation for several transcontinental flights contemplated by the senior service for this and other ships of this type.

In design and construction the new airship carries several features especially arranged for the use of helium gas, which will be the standard lifting power of this type.

Her envelope has a gas capacity of 200,600 cu. ft. and she is 195.81 ft. long.

The car suspended from the envelope is 40 feet long and contains accommodations for a crew of six men when helium is used. When hydrogen is used a crew of ten men can be carried.

Two Hispano Suiza motors of 150 horsepower each furnish the driving power. A speed of 60 miles per hour can be maintained with a range of 1070 miles. Slackening down to a speed of 47 miles per hour she will have a cruising range of 1,630 miles.

The T-C-1 is equipped with bomb carrying and releasing devices. One 1,200 lb. bomb, four 400 lbs., and eight 100 lbs. will be carried.

She also carries a complete radio installation of the latest type.

The crew which carried the T-C-1 through her preliminary tests was composed of: Lt. F. M. McKee, test and instruction pilot, Lt. C. Kunz, test pilot and engineering assembly officer, both of Scott Field, Belleville, Ill., Lt. J. Cluck, official observer and pilot of the Air Service, Washington, D. C., Sgt. Harry Barnes and Sgt. Olin Brown, motor specialist from Scott Field.

AIRPLANES IN THE DEPARTMENT OF AGRICULTURE

GOVERNMENTAL use of aircraft is on the increase. The Geological Survey, Coast and Geodetic Survey, the Engineers, the Bureau of Mines, the Post Office, the Weather Bureau, and the Department of Agriculture are all making all possible use of the airplane.

With the production of proper types, with increased flying personnel, increased appropriations, further extensions of the application of aircraft of all types are to be looked for in the not too distant future.

The Department of Agriculture is again to scout by air in the campaign against the boll weevil.

During the Summers of 1918 and 1919 an airplane was used in certain sections of Texas to locate isolated cotton fields that might otherwise have escaped inspection and might possibly have been infested with the pink boll worm. This scouting work was successful. Secretary Wallace says so himself. But it was discontinued because of an accident in which the plane was destroyed and both the pilot Lieut. Tillisch and the observer E. L. Diven lost their lives.

This scouting work was probably the first use of the airplane in agricultural work.

This experiment was made possible through the cooperation of the Army Air Service, which loaned Lieutenants Wm. H. Tillisch, and Harold Compere, the first boll weevil pilots of record. The work was prosecuted for over a year with great success and was particularly valuable in the scouting necessary along the long stretches of the Rio Grande where roads or other means of transportation are poor or insufficient. Although these flights had been conducted over a long period without serious accident, the danger of the service was recognized and the greatest honor is due these men for remaining beyond their allotted time in the service because of interest in this new use of the airplane.

At Riverton, N. J., an airplane was used in October, 1919, by Lieut. Potter, in the photography of the area infested with the Japanese beetle.

Crop reporting is a probability. The airplane's ability was demonstrated on April 30, 1919, when Ohio field agent Col. J. L. Cochrum made a survey of the progress of spring plowing in Montgomery County, O., from an airplane. A fairly good conception of spring work was obtained as well as the proportion of the total acreage that was under cultivation. This suggests the use of the camera in the making of these crop surveys, said the Monthly Crop Reporter of the Department of Agriculture.

The airplane proved more advantageous than the horse in the dusting of cotton with calcium arsenate. In August, 1922, the Department took up trials of the airplane, equipped with special hoppers and dusting apparatus, for fighting the cotton worm and the boll weevil in Northern Mississippi. The results showed a great deal of promise for this method. The dust is distributed very effectively over the field, the new method giving better results than horse-drawn dusters. The Department thinks enough of this that it is preparing a report on this work for publication.

The gypsy moth is not to be undisturbed. In June, 1922, a number of trial flights were made over two forest areas in New Hampshire near Alton and Hooksett where the gypsy moth had appeared in large numbers. However, in this instance the moth had a bit the best of the argument.

Dr. L. O. Howard, Bureau of Entomology, of the U. S. Department of Agriculture, refers to experiments in Canada in the location of insect damage to forests. He expresses the belief, through AERIAL AGE, that planes might be of value in locating green fly damage to wheat. In winter wheat in Texas and Oklahoma the insect appears first in spots which it is important to recognize immediately. Such spots may be seen from above when they would not be noticed by a man on the ground.

Airplanes are not alone in their travels. Rust spores have taken to the airways. In an investigation of the extent to which rust spores were distributed by air currents, flights were made in the Summer of 1922 from fields at San Antonio, Tex.; Fort Crook, Omaha, Nebr.; Minneapolis, Minn. (in cooperation with the Minn. National Guard); Chanute Field, Rantoul, Ill.; McCook Field, Dayton, O.; and Camp Knox, Louisville, Ky., by airplanes of the Army Air Service. Spores of stem rust were found in the air at altitudes of from 1,000 to 10,000 feet. It is significant to the U. S. D. A. that the number of spores caught in the air decreases rather rapidly as the distance from rusted grains and grasses increases.

The Forest Service in 1921 furnished another definite example of the Department's foresight in the application of aircraft to peacetime [illegible] of the damage done by the hurricane on the Olympic Peninsula.

In 1922 the Forest Service used an airplane for scouting [illegible] charted lakes in the forests of Alaska where plans were being made for hydro-electric development.

We are quite familiar with forest patrol by airplane established in 1919 under the cooperative agreement with the Army. This agreement expired in 1921 and has not been renewed. Airplanes are still occasionally used on the Pacific Coast for taxi service on large fires or for patrol over especially hazardous areas, and they will probably always be used, if funds and planes are available, as an adjunct to the ground lookout system, for which purpose airplanes are admirably adapted.

[illegible] "first report" fires received from airplanes, led the Forest Service to [illegible] this method of fire detection.

The Ohio Agricultural Experiment Station [illegible] force in early August and were stripping the new crop of leaves from the trees when the dusting checked them on August 4th, 1921.

Six passes by the grove were made by the machine, though it is believed less would have been sufficient. The time during which dust was spilling from the hopper was 57 seconds. The airplane passed about 50 feet out from one side of the grove and 20-30 feet above the tops of the trees. A strong wind carried the dust over the entire grove, nearly 400 feet wide and it could be found in easily perceptible quantities on weeds and grasses for 150 feet in the pasture on the distant side of the grove. Effective dusting was, therefore, done over a width of about 600 feet or at the rate of about 10 acres per minute and since the passes can be reduced with perfected apparatus from 6 to 2, a normal rate of application may be expected to be about 30 acres per minute, says Mr. H. A. Gossard, state entomologist. Within 3 days after the application 99 per cent of the caterpillars were dead and were strewn on the ground, hanging from the trunks and limbs, making the grove indescribably foul and repulsive.

"I feel sure that one airplane can dust a strip of forest or a pecan orchard in less time than 20 of the most powerful liquid spraying machines can cover it.

"The problem is to perfect dusting materials so they will give results comparable with those obtained by liquid spraying.

"Applications of arsenate of calcium for case bearers and budworms on large orchards of big trees can probably be made more satisfactorily and expeditiously by airplane than with sprayers."

New Pursuit Planes for Selfridge Field

Selfridge Field, Mt. Clemens, Mich., has recently received several of the new PW5 Fokker Monoplane Pursuit planes. These are now in operation, being given daily service tests. Their value as Pursuit ships has not yet been determined.

Air Service Operates its Own Freight and Passenger Service

The Army Air Service does not have to rely on the railroads to transport its personnel and supplies. Aside from effecting considerable economy in transportation charges, the saving in time incident to using the fastest mode in transportation of the present day, the airplane contributes not a little to the efficient operation of this branch of the military service. Very frequently, whenever it is found necessary to transfer officers and enlisted men from one station to another, some of them as far distant as 800 miles, the airplane furnishes an economical and rapid means of transportation. By using a Martin Bomber it is possible to transport five or six men at one time. A considerable number of enlisted men at the various Air Service fields who are detailed to take the course of instruction at the Air Service Technical School, Chanute Field, Rantoul, Ill. for training as mechanics, make the journey via the air route.

Some months ago, when the Air Service troops at Ellington Field, Houston, Texas, were transferred to Selfridge Field, Mt. Clemens, Mich., a distance of 1,600 miles, practically all of the personnel traveled to their new station by airplane. The entire cost of the journey by air was estimated at a sum $6,448 less than it would have cost the government had the movement been made by rail.

The Air Service, however, does not confine its transportation operations to passengers alone. A report recently received by the Chief of Air Service from the Commanding Officer of the Middletown, Pa., Air Intermediate Depot, states that in less than three months, beginning Jan. 1, 1923, and during a period of bad weather, 12,000 pounds of freight have been moved by air from that depot to various other Air Service fields. These shipments consisted of spare parts for airplanes and engines, aviator's clothing and miscellaneous stores. Of this volume of freight, 1500 pounds were transported in DH4B airplanes, 4300 pounds in Martin Bombers and 6200 pounds in Handley-Page machines.

While statistics are not at hand showing what the other Air Service depots have accomplished in the way of transporting supplies by airplane, the activity of the Middletown Depot in this regard furnishes ample evidence as to what the Army Air Service is doing with reference to freighting its own supplies, and this in military planes which are not built for freight-carrying.

Unlike England, France, the Netherlands and other foreign countries, the transportation of freight in commercial airplanes has not yet come into general practice in the United States. It would seem that using commercial planes of suitable types, the transportation of freight via the aerial route presents unlimited commercial possibilities.

Master Craft Sign Co. Offers Special Service

The Master Craft Sign Co., with their place of business at 67 West Burnside Ave., New York City, is offering Aviation interests a service which has long been wanted. R. J. Smith and W. O. Waldecker, both well known in aeronautical circles, are applying their knowledge of Flying and Commercial aviation in general to Commercial Art and Advertising, for the benefit of all who require a service of this kind. With the assistance of an internationally known artist and various expert designers and illuminators, they cover the entire field of illuminating and designing as set down hereunder. At the time of writing Mr. Smith informs us that all kinds of orders are being received by the Company and are being executed expeditiously and with great care.

Aircraft Clubs, Flying organizations, and individuals wishing any kind of special designs, Drawing, painting, sign, showcard, letterhead, private or club Menu, book cover, book plate, resolutions, advertisement, boat design, wood, metal, canvas, paper, or mat-board sign or Heraldry of an artistic or plain (in the case of Aerodrome signs of warning to the public) should write to this firm before ordering elsewhere.

Mr. Smith says "I want to give to the Flying interests something out of the ordinary, something really good, valuable from an advertising point of view as well as an artistic one. I am putting my heart and soul into the work, and trust that I shall receive the support of the Flying fellows. Only work of excellent quality containing all necessary detail will leave the studio, although I am busily executing orders for firms outside of the Aircraft circle, I am specializing on aircraft designs for advertising purposes, etc., because of my love for flying. I will execute any order large or small, and cheerfully estimate."

Mr. Smith is late of the R. A. F. He also was Manager of the National Aircraft Underwriters Assn. and until returning East was Residential Aviation Engineer for the Pacific Coast for the Underwriters Laboratories. Mr. Waldecker, his partner is late of the United States Air Service.

Allen Addresses A. E. S.

Mr. Edmund T. Allen, President of the Aeronautical Engineering Society at the Massachusetts Institute of Technology, has recently returned to the United States after spending several months in Europe where he has attended the various glider meets and has made a study of the science of gliding.

At a meeting of the A. E. S. on March 2, Mr. Allen, who is an authority on gliding, addressed the Society. His talk was an account of the French, German, and English competitions which he attended, and was illustrated by lantern slides showing the most prominent gliders participating in these contests. He described gliding as the greatest sport in the world, and believes it has an extremely promising future. Mr. Allen intends to continue his activities in the science of gliding to an even greater extent in the future.

After the meeting, moving pictures were shown of Allen's last flight in the second M.I.T. glider in Germany. In this flight the machine was wrecked, and seeing these moving pictures of the flight was Allen's first opportunity to determine exactly what happened at the time of the accident.

It will be remembered that it was Mr. Allen who was very largely responsible for the construction of the M.I.T. gliders by the Aeronautical Engineering Society a year ago. Last summer Mr. Allen, with O. C. Koppen and H. C. Karcher, comprising the M.I.T. glider team, took these two gliders to Europe where one of them was flown by Allen in the International Gliding Competition held at Clermont Ferrand, France. This machine was the only glider representing America in the Competition. During the time that Allen took part in the contest his performance was not excelled by that of all other competitors combined. He was later eliminated from the contest by an accident which disabled the glider. Mr. Allen later made some flights with the second M.I.T. glider in Germany, and since then has made a study of the art of gliding at the other meets which have been held.

The Composition of Various Metals

Aluminum is light in weight, possesses a high ratio of strength, is worked and will not rust. Its use for aircraft is extensive. It may be cast or welded.

Aluminum Bronze has nearly double the tenacity of gun-metal, is not liable to rust, and can be forged either hot or cold. It is composed of 90 parts copper and 10 parts aluminum.

Babbit's White Metal is composed of 10 parts tin, 1 copper, and 1 antimony.

Brass is an alloy of copper and zinc, with a small quantity of tin added to increase the hardness or vary the color. Lead may be added to increase the ductility and make it more suitable for turning or filing. It is very malleable and easily worked cold, but not fit for forging at a red heat. A good mixture is 2 parts copper, 1 part zinc.

Bronze or Gun-Metal is an alloy of copper and tin, but a little zinc is added to increase the fusibility. Tin increases the hardness and mixes well in all proportions for general purposes, 5 parts of copper to 1 of tin.

Cast-Iron contains from 2 to 5 per cent of carbon, is stronger under compression than wrought-iron, weaker under tension.

Copper is very tough and elastic, of considerable strength, malleable and ductile, suitable for hammering into forms requiring strength and elasticity combined with lightness.

Duralumin is a more recently developed alloy which is as strong as mild steel and only slightly heavier than aluminum. It is becoming more in use for aircraft every day. It will not permit of bending unless first annealed to soften it and then heat treated to restore or increase its strength. It may be cast but at present no satisfactory methods have been devised to weld it.

Manganese Bronze is a close-grained bronze, with a proportion of ferromanganese, can be rolled either hot or cold, very tough and strong, largely used for propeller-blades, etc.

Munts' Metal is composed of 3 parts copper and 2 parts zinc. It has a very high tenacity, very ductile, and can be forged hot, and if hammered or rolled cold can be used for springs.

Phosphor Bronze is very hard, tough, close-grained alloy, composed of copper or tin with a small amount of phosphorus. Composition for bolts, etc., 90 per cent. copper and 10 per cent. phosphor tin to contain about 10 per cent. of phosphorus.

Steel is a compound of iron with from .1 to 1.5 per cent. of carbon; these kinds containing less carbon are more easily welded and forged, and are termed mild steel, used for plates and forgings. The presence of manganese increases the toughness and makes it easier to weld.

Wrought-Iron is nearly pure iron, produced by abstracting the greater portion of the carbon from cast-iron, that containing about ¼ per cent. being almost equal to mild steel. The longitudinal strength is increased by rolling, and the tensile is greater with the grain than across.

Zinc is brittle when cold, malleable when hot. It is little affected by the air of weak acids and is therefore much used in coating metals to protect them from the action of the air or sea water.

(Concluded from page 240)

of Topeka is the Chairman of the Advisory Committee.

Iowa:

Davenport: Hon. Alfred C. Mueller, Mayor, is Chairman of the Advisory Committee, Mr. J. A. Russell is chairman of the Membership Campaign Committee with Mr. B. Richardson as Secretary.

Cedar Rapids: Mr. R. G. Grassfield is Chairman of the Membership Campaign Committee, Mr. Charles D. Manson, Secretary with the following members: Judge J. H. Treqin, P. C. Rude, Forest McCook, Victor Obenauer, and Peter Hoyt.

Waterloo: Chairman of the Membership Campaign Committee is Mr. Milo H. Miller, with the following members: Hon. W. W. Marsh, John T. Sullivan, and L. B. Strothman.

EIGHTH DISTRICT

The Chairman of the District Committee is Dr. Frederick Terrell of the City National Bank of San Antonio, Texas, with Mr. J. R. Riley as Executive Chairman and Treasurer, and Mr. George L. Rockwell of San Antonio also, as Executive Secretary.

Texas:

Galveston: Mr. Ralph Kern U. S. Engineer is Chairman of the Membership Campaign Committee.

Houston: Mr. Alva W. Snyder, is Chairman of the Membership Campaign Committee.

Oklahoma: Governor J. C. Walton is Chairman of the State Advisory Committee.

NINTH DISTRICT

The District Chairman is Mr. Cecil B. DeMille of Hollywood with L. F. Parton of San Francisco as Executive Secretary and Geo. B. Harrison of Los Angeles, secretary for the southern section of this district.

San Francisco: State Advisory Committee is made up of the following men:—Mayor Rolph, Chairman, Lt. Col. Gilmore, J. C. Irvine, Col. Ansen Wright, Albert Michelson, Judge Sylvester J. McAttee, R. Reed, Fred A. Tillman.

Los Angeles: The Advisory Committee is made up of Ewell D. Moore, George L. Metcalfe and Guy Moyston.

Nevada: Governor Scrugham is the Chairman of the Advisory Committee.

Utah: Governor Charles R. Mabey, is Chairman of the Advisory Committee for Utah.

NATIONAL AERONAUTIC ASSOCIATION,
Official: By: C. A. Tinker,
Director of Information.

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We wish to thank our friends for their generous response during our Removal Sale. All parts now stored at Bradley Beach. Address all mail to Asbury Park.

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1.	Curtiss Canuck—overhauled [illegible] —a bargain at	[illegible]
2.	Curtiss Canuck [illegible] and linen [illegible]	[illegible]
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5.	New covered right lowers	40.00
6.	New covered left uppers	50.00
7.	New covered left lowers	50.00
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9.	New covered horizontal stabilizers	18.00
10.	New covered elevators (few slight holes)	2.50
11.	New covered ailerons (upper or lower)	4.00
12.	New uncovered rudder, aileron, elevator, or covered vertical fin	1.50
13.	New rudder bars, [illegible], aileron distance rods, each	1.50
14.	Axle, pair l.g. vees and rear (2) sockets	5.00
15.	Axle, struts (interplane) with fittings, pair of landing vees, each	2.00
16.	Used (A-1) center section, propeller hub, Rome-Turney (slightly used) radiator, each	7.50
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19.	D-5000—Buffalo—Plain tip—8' x 5' 3"	10.00
20.	Nearly new Curtiss propellers for OXX (R. H. [illegible])	10.00
21.	Used Paragon or D-5000	5.00

JN4-D

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26.	Covered rudders	6.00
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29.	Axle, peach baskets (2) and four undercarriage fittings	5.00

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32.	Lee Tires for above (new) 32 x 4½—two for	35.00
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35.	Air speed indicator (Foxboro)—without [illegible] or tube	10.00
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38.	Large Curtiss "R" tail group—covered complete or steel undercarriage	30.00

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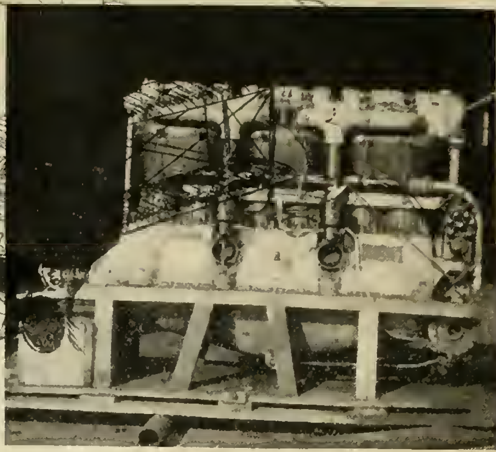

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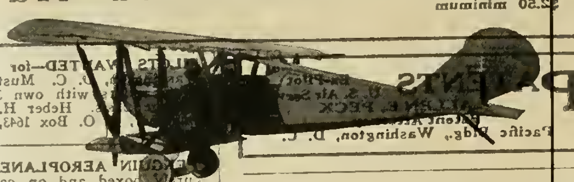

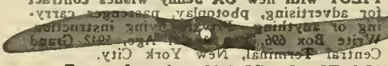

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Flottorp	Birch		D-5000	8'	5'6"	20.00
American	Oak		Toothpick	8'4"	5'	15.00
Paragon	Oak			8'3"		15.00
Liquid Carbonic	Birch		"	8'	4'	15.00

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Statement of the Ownership, Management, Circulation, etc., Required by the Act of Congress of August 24, 1912

Of AERIAL AGE published Monthly at New York, N. Y. for April 1, 1923

State of New York } ss
County of New York }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared G. Douglas Wardrop, who, having been duly sworn according to law, deposes and says that he is the Editor of the AERIAL AGE and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Aerial Age Company, Inc., 5942 Grand Central Terminal, New York; Editor, G. Douglas Wardrop, 5942 Grand Central Terminal, New York; Managing Editor, None; Business Manager, G. Douglas Wardrop, 5942 Grand Central Terminal, New York.

2. That the owners are: Aerial Age Company, Inc., 5942 Grand Central Terminal, New York; G. Douglas Wardrop, 5942 Grand Central Terminal, New York.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stocks, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is .... (This information is required from daily publications only.)

G. DOUGLAS WARDROP.

Sworn to and subscribed before me this 27th day of March, 1923.

Carolyn E. Jones
Notary Public, Bx. Co. Clerk's No. 31, Certificate filed N. Y. Co. Clerk's No. 355, N. Y. County Registers No. 3040.
(My commission expires March 30, 1923.)

[Seal]

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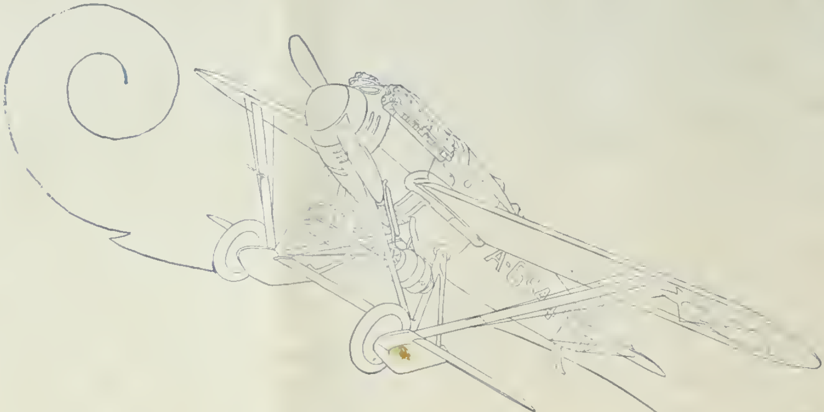

MEASURING UP TO A FAMOUS NAME

Where an industry is so dependent upon wide experience and correct engineering practice as in that of Aviation, it becomes essential for an organization within it to have a background of achievement with which to measure the quality and soundness of their effort.

Wright Achievement began nineteen years ago in the production of the first successful flying machine. It has continued to mark the progress of flying ever since.

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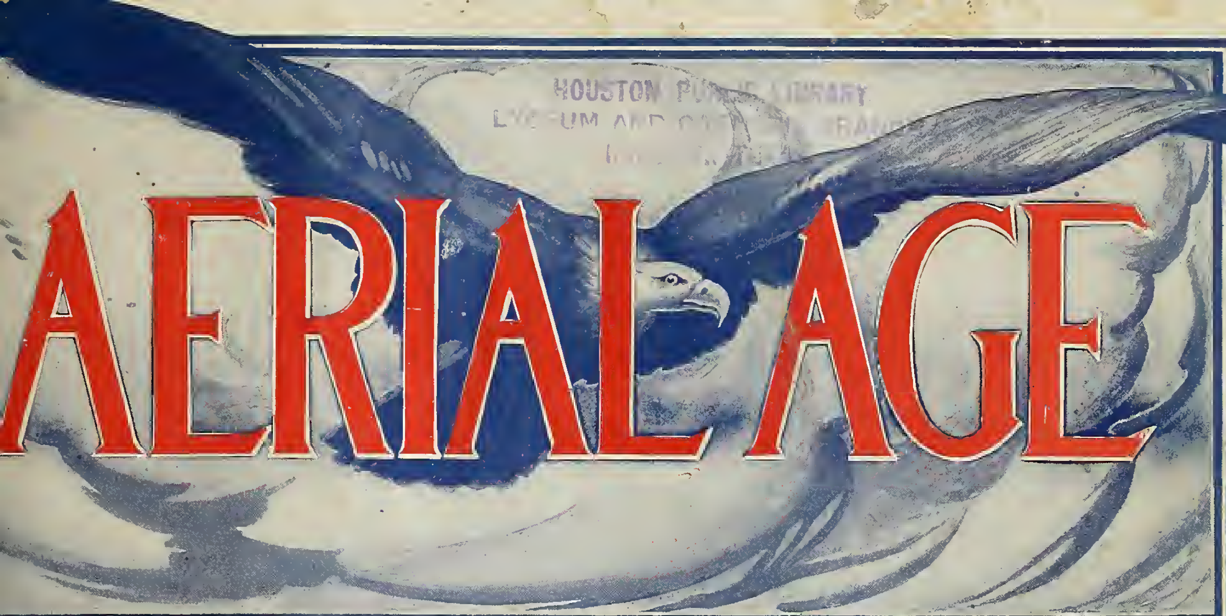
AERIAL AGE



VOL. 16, No. 6 | June, 1923 | 25 CENTS A COPY

Air Mail Delivers Striking Evidence Against Inaction

By M. Clyde Kelly

The Race For Air Supremacy

By Rear Admiral Moffett

Air Travel With Reference to the Helicopter

By Major F. M. Green

The Martin-Navy All Metal Scout Seaplane

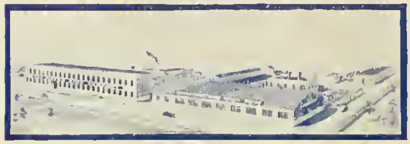
OFFICIAL REGULATIONS GOVERNING BRITISH HELICOPTER COMPETITION FOR $250,000 IN PRIZES

Positive Proof of Consistent Dependability

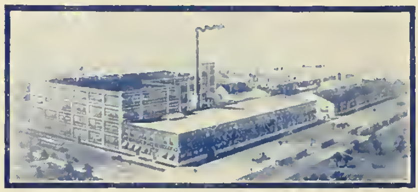
QUALITY SNAPRINGS

NOV. 30, 1911

DEC. 1, 1912



JUNE. 15, 1915



SEPT. 1, 1916

SEPT. 1, 1920

April 1, 1923. Ground broken for $250,000 foundry building. Electric furnaces and special equipment will be installed, designed for a production of over 20,000 piston ring castings per hour. When completed this will be, without question, the most modern and efficient piston ring foundry in the world.

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Muskegon, Michigan

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Contributing Tech. Editor

AERIAL AGE

With which Flying *is consolidated*

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TABLE OF CONTENTS

PUBLISHED MONTHLY BY THE AERIAL AGE COMPANY, Inc., 5942 GRAND CENTRAL TERMINAL, NEW YORK CITY
Subscription: Domestic, $3; Foreign, $5. Entered as second class matter, March 25, 1915, at the Post Office at N. Y. under the Act of March 3rd, 1879; also entered on September 22, 1922 at the Post Office at Bethlehem, Pa.

SKF

Deep-Groove Ball Bearings

Take Propeller Thrust at 248½ Miles Per Hour

THE hitherto unattained speed of 248½ miles per hour was achieved by Lieut. R. L. Maughan on October 17th with an Army-Curtiss Racer, equipped with a Curtiss D-12 engine developing 460 H. P. The force developed through the 7½ ft. propeller, turning at 2,300 R. P. M. with a peripheral speed of over 10 miles per minute, was communicated to the plane through a single deep-groove radial ball bearing, 5.9 by 1.1 inches in overall dimensions, made by the Hess-Bright Manufacturing Company.

A similar bearing took the propeller thrust on the Curtiss Army Racer with which Lieut. Maughan won the Pulitzer Speed Trophy, on October 14th, for a distance of 250 kilometers—average speed 205.8 miles per hour.

The Curtiss company were pioneers in the use of deep-groove ball bearings to take propeller thrust and the latest performances merely confirm the dependability and stamina of this type of bearing under unusual service conditions.

THE HESS-BRIGHT MANUFACTURING COMPANY

Supervised by SKF INDUSTRIES, INC., 165 Broadway, New York City

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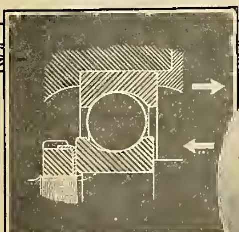
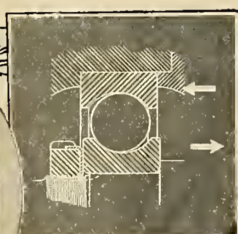


Races displaced to show DEEP - GROOVE bearing carrying maximum end thrust in a forward direction.



Races displaced to show THE SAME bearing carrying maximum thrust in reverse direction.

BALL BEARINGS

The Highest Expression of the Bearing Principle

The Race For Air Supremacy

Speech delivered by Rear Admiral W. A. Moffett, U. S. N., chief of the bureau of aeronautics, Navy Department, before the St. Louis Chamber of Commerce.

I WANT to render an accounting to you today of an enterprise in which you are all stockholders. That enterprise is your naval aviation service. It is the eyes of your fleet, and the guardian of your gateway to the world.

The matters of which I desire to speak to you have engaged the serious thought of individuals and nations throughout the whole world, during the past few years. As a result we find ourselves today with a challenge in the air—a race for air supremacy, commercially, industrially, and as an instrument for national defense. There is, perhaps, no nation in the world more concerned with problems of national defense at the present time, than is France. As a solution of these problems, she has developed the most powerful air strength in the world. Great Britain has of late years evidenced more concern for aviation development than she has for the strength and integrity of her fleet. The nations of the world and the great minds of the world recognize the fact that air supremacy spells national security.

I have never put forth the claim for aviation that it would revolutionize the world as regards national defense, or any other line of human endeavor. Aircraft are no more a substitute for armies and navies, than they are for automobiles. They are, however, a tremendously important factor in national defense, and they are destined to play an increasingly important part in our industrial and commercial life.

All of this leads us naturally to the question "What are we doing in this country?" and speaking for the Navy, I answer that question "As much as we possibly can." For we fully appreciate the fact that without aircraft our ships are well-nigh helpless, when pitted against ships which are served by strong and efficient aviation service. Economy has been the watchword in government expenditure in this country, and aviation in the navy has had to try to make one dollar do the work of two. Every penny that has been expended for naval aviation has been spent to develop aircraft for our fleet, and it has taken careful thought and planning to get a maximum return for our money. Bearing this in mind, I want to tell you what has been done.

We have, today, the best naval planes in the world, though they are relatively few in number. We have a comparatively small naval aviation force as regards personnel. As regards ability, efficiency, and high standards of morale they are the equal of any similar body of men throughout the world. It is our aim to equip every fighting ship in the Navy with aircraft, from the largest dreadnaught to the submarines. We are building for the Navy, and the work is being done by the Navy, the first rigid airship to be constructed in this country. We have developed a catapult for launching planes into the air from the deck of a battleship. We have successfully perfected means for directing and controlling the fire of battleships from the air. We have saved millions of dollars by developing aircraft carriers through experiments with the ex-collier Langley, rather than make costly mistakes with new types, and the results obtained are worthy of the best traditions of American ingenuity and resourcefulness.

We have perfected the torpedo plane which is, in effect, a destroyer in the air. Our air squadrons have just returned from a 7000-mile cruise to the Panama Canal, where they had an important part in the maneuvers of the combined fleets. From Guam to the islands of the Caribbean our interests are safeguarded by squadrons of aircraft, manned by Marine Corps pilots.

All of this sounds war-like and militant, but it only represents what is being done by your representatives in the Navy to keep faith with the trust that you have reposed in them, and it is a part of our duty to keep you informed of what is being done and of the needs of the navy, which are, in the final analysis, your needs. Within the past few years, we have had the greatest full scale lesson in preparedness in the history of our country. I do not need to point out to you the salient features of this costly lesson. They are known to all of us. But I must point out the fact that another such lesson which found us unprepared in the air, would probably result in a national disaster. You have heard military training as a measure of preparedness, urged by the most prominent leaders in the country. Every thinking man recognizes this as a measure of safety and sound economy. On the same grounds and of even greater urgency, is the need for aviation training throughout the country. In a national emergency, we could not create an air service over night. The building of air power is comparable to the building of sea power. It is based on years of experience and training. In the event of war, the cry would be for trained pilots by the tens of thousands. We have been unable to build up a reserve for naval aviation with the funds that have been alloted. We can barely meet the requirements of the active naval forces with these funds. We have only been able to build a solid foundation for our structure, but my warning is, that the structure itself cannot be put up in a day.

England and France are spending millions to create a reserve for aviation in the Army and in the Navy. This money is being expended in subsidy for commercial aviation. This country has even neglected to pass laws, regulating commercial aviation. Such laws would be a great stimulus to aeronautics, for they would stabilize commercial air transportation and facilitate its healthy growth by creating public confidence in aviation. This confidence is now lacking largely because of the uncontrolled and irresponsible "gypsy" flyers who operate without restraint and very often with unsafe equipment.

Another important consideration has been neglected, and this is the conservation of our helium supply. We are the only country in the world having a supply of helium adequate for an ambitious airship program. This supply of helium is a natural resource of incalculable value. It would enable us to develop airships on a scale which would be impossible in any other country in the world. Helium in airships practically eliminated the fire hazard, and this hazard has been the weakest characteristic of airships. The use of helium would be of tremendous advantage in the development of commercial airship transportation. Immediate measures should be taken by the government, looking to a comprehensive program of conservation of this valuable, natural resource. We are operating a helium plant at Fort Worth, Texas, at the present time, to supply our immediate needs, but there are other localities where helium can be produced, and where it should be conserved for the future.

The Limitation of Armament Treaty allows to this country 135,000 tons in aircraft carriers, and a similar tonnage is allowed to Great Britain. The so-called 5-5-3 ratio is an acknowledgment by the world powers, that this country should of right maintain a Navy equal to that of any in the world. This, they have admitted is commensurate with the dignity of the United States and is a necessity to protect our interests. Our policy of non-participation in the counsels of Europe lends even greater force to this need. You may or may not have heard that we are not maintaining this status, as regards aviation. Great Britain has six aircraft carriers in commission—we have one. And that is an experimental type totally unsuited to war time uses. We have two carriers now building, but these will give us less of our allowed tonnage in these vitally important ships.

In conclusion, I would emphasize the following points:

No development of the age in which we live is of greater significance from a standpoint of national defense than is aviation.

The Navy has developed an aviation service of gilt-edge A-1 quality, but of inadequate size to serve our best interests. We are prepared to expand this organization when the vital importance of it has been borne in on the consciousness of the people to whom it belongs.

AIR MAIL DELIVERS STRIKING EVIDENCE AGAINST INACTION

Record of Four Years and Seven Months Wins World Commercial Transportation Leadership for United States

By M. Clyde Kelly

Member of Committee on Post Offices and Post Roads in the House of Representatives; Lawyer; Publisher.

RECENTLY one of the world's greatest manufacturers said of aviation, "About all we have learned so far is that we can fly; the rest is yet to be learned." Perhaps that is the average man's conclusion. I have just received the detailed statement statistically presenting the performance of the Air Mail Service since its inauguration May 15, 1918, to Dec. 31, 1922—four years and seven months. This statement shows that not only have we learned how to fly in any condition of weather, but that we have put flying to a very practical use. We have demonstrated to the country that the commercial usefulness of the airplane surpasses in reliability and speed all other means of transportation on land and water.

No language can be extravagant in expressing the marvelous record of our Air Mail. Language is a poor vehicle because one can not hope indelibly to impress upon the minds of the people, and especially the consciousness of our men and women whose activities are making this nation great, the stimulating facts of the Air Mail. Words do not suffice to prove that with the Air Mail this country has grasped the palm of world leadership in this new phase of air transportation. I wish it were possible to engrave upon every active mind these facts:

For four years and seven months the Air Mail Service—

Made 90.39 per cent of all deliveries.

Flew through fog, rain, snow and hail 36.33 per cent of that time, or 20 months of storm out of the 55.

Air Mail planes traveled with mail 4,623,115 miles, or an average of 84,056 miles a month.

Air Mail planes carried 160,473,600 letters, an average of 2,917,884 letters a month.

Of the 24,988 trips scheduled, only 873 were uncompleted.

An Airplane is a single unit—and no single transportation unit I dare say in all history has approached Air Mail plane efficiency over a period of four years and seven months.

The air conditions that the Air Mail meets with such extraordinary performance are the most varied to be found on the earth's surface. The records cited were daily schedules on the New York-Washington route; the Chicago-St. Louis route; the Minneapolis and St. Paul-Chicago route; New York-Cleveland and Cleveland-Chicago routes; Chicago-Omaha and eventually Omaha-San Francisco—terrain with three mountain ranges, the Allegheny, the Rocky and the Sierra.

It is right and just to declare that the entire performance of the Air Mail Service stands alone at the peak of all transportation records. It stands as an achievement for the world to aim at, and it stands, too, as the example for the business people of the nation of what is practical in air transit in commercial carrying of goods and passengers. Nothing, in my opinion, that the National Aeronautic Association can advance to convince our people that it is a patriotic duty for them solidly to support the movement, to foster, encourage and advance aeronautics can make the impress that these convincing facts of the Air Mail Service must make upon the minds of those who are capable of constructive thought.

Since the inauguration of the New York-San Francisco service in September, 1920, the Air Mail has flown an average of 137,686 miles with mail every month, or nearly six times the distance around the earth at the equator every thirty days, although the Air Mail does not fly on Sundays and holidays. Phineas Fogg of my boyhood with his fictional trip around the world in 80 days has certainly evaporated and isn't even a myth in reckoning the day by day work of our Air Mail pilots.

We have planned some startling tests for our American aircraft, polar voyages in our new airships, actual world-circling flights, and an over land and sea route to China. But to me, as a business man, such projects pale into insignificance so far as they affect the practical side of affairs alongside the performance of the Air Mail Service. That is actual; it stands solidly on known efficiency; it shows the way to a real utility that can benefit all the people; it demands that the mail must fly everywhere so that our Post Office Department shall be genuinely a department of communications.

What are we waiting for? We have proved the advantages of aerial mail transportation by nearly five years of the hardest kind of test. Why do our industries, our commercial and financial interests, our agriculturists want further to show that the air ocean is a free sea for transit that will give them and all of us the greatest boon yet vouchsafed mankind?

The Air Mail must cover a network of air lanes between all the important centers of the country, not alone because airplanes annihilate time and distance but because they have attained a standard of scheduled transit that approximates a degree of perfection no other means affords. Give the Air Mail the rate of the star route carriers of two cents a letter and it is entirely within reason to look for the service to operate at a handsome profit after deducting all expenses, capital account, depreciation, etc.

What are we waiting for? Commercially the airplane is a success. Then why does business hesitate and stand in its own light instead of getting behind the commercial advancement of airplane carrying of goods and passengers and profiting by it? It is perhaps due to our characteristic hesitancy, our ultra conservatism, if you will. The airplane on the mail routes for more than four years has shown us a timidity in feeling that nothing good remains to be discovered is a fallacy. The warranted enthusiasm over the Air Mail record of performance breaks down conservatism as a means of defense. The proof is submitted. Character, capacity, utility, profit are there in the figures of the Air Mail Service—proved by trial for 55 months.

Why content ourselves with the feeble expression, "The mail must fly!" in the hope that the people and their representatives in the Government will hear it and force the issue? The mail does fly better than 95 per cent across the continent. Business can, if it shelves its timidity, make it fly over the entire continent as nearly perfect as human ingenuity can approximate perfection. Business is a heavy loser today and every day that it clings to its conservatism so close that commercial aeronautics remains a puny infant. What are we waiting for?

The Martin-Navy All Metal Scout Seaplane

TESTS have just been completed on Lake Erie at Cleveland of the Navy's latest seaplane, the MS1, designed by the Navy for shipboard use and developed by the Glenn L. Martin Company. So far as is known, it is the smallest seaplane ever built.

This "mechanical humming bird" is entirely of metal with the exception of the covering, and is only 18 feet wide, 17½ feet long and 7½ feet high from the water line. Its actual weight is less than 650 pounds. Notwithstanding its small size, it is a real airplane, handling and maneuvering in the air as well as much larger planes. While it is not permissible to give actual performances, its speed is quite high, considering that it is a seaplane and that its motor is of low horsepower.

The power plant is a Lawrance, model L 4 S, three cylinder, air-cooled motor of 60 h. p. It carries a 6½ foot propeller. The motor is mounted on a vertical bulkhead at the end of a rectangular fuselage built up entirely of steel tubing. The method of assembling the fuselage is worthy of special note. It is built in a jig, the various members being held in place by special clamps until all the fittings have been made. This results in a perfectly rigid structure which requires practically no truing up. The fittings themselves are quite simple being attached in place by rosette welding. This method, which was developed at the Martin factory, consists of drilling holes through both the main members and the fittings and torch-welding the material around the radius of the holes. Tests on this type of fitting have shown exceptional strength while it also allows for a minimum of weight.

The Martin-Navy All Metal Scout Seaplane

The pilot's cockpit is roomy and all the controls and instruments are readily accessible. Outside of radio equipment, no military load is carried.

The tail surfaces and wings are made up entirely of duralumin, channel sections being used largely for the bracing, while the ribs are stamped out of the material in one piece. Two-inch tubular duralumin is used for the wing beams. The leading and trailing edges are of channel duralumin riveted to the ribs. The wings, as well as the fuselage and tail surfaces, are covered with linen.

The wing interplane bracing is accomplished by one set of "N" struts on each side. The flying and landing loads are taken by diagonal struts between the floats and the outside of the lower wing. The lower wings are attached to the fuselage bottom longerons, while the upper wings join at a cabane section above the fuselage. This arrangement permits of easy assembling or dismantling in case it is desired to stow the plane in a very small space.

Unique in seaplane construction are the floats. These are entirely of duralumin, the structure being built up of channel section bracing with water tight bulkheads. The float fittings for the brace struts to the plane structure are aluminum alloy castings. Sheet duralumin is used for the float covering. All joints are made water tight by the use of wicking, impregnated with marine glue, placed in the joints at the time of riveting.

All interplane and float struts are streamlined with sheet duralumin. The gasoline tank is of welded aluminum and holds twelve gallons—sufficient fuel for a flight of two hours at full speed.

Flying a Peaceful Pastime

OH, TO BE an aviator! "Far from the madding crowd's ignoble strife" flies Folly H—— of the flight test field and his fancy flying pals.

On they come from Kelly and Mitchell and everywhere, carefree, conscientious, peppy, two-fisted—fighters from the word "go" and out they go when they're through. Christians they are, with the fear o' God in their hearts or else they're pushin' up the daisies.

Gi' *me* the old crate and I'll fly her. And they do.

The life of a test pilot at McCook Field certainly can't be called dull. There's something new all the time.

See that bird over there! That's ——, chief of the flight test department. They gave him one of those side-door Pullman monoplanes, with the cockpit just big enough to stick your head through after you wriggled in through the door like a worm. He's *got* something on the ball. Not for mine! I don't mind an archie or two bustin' under my tail but nix on this test stuff. He took this bus out one day and I'm here to say that I don't envy him, not a damn bit. Foxy Granpa, you know who I mean, well, Foxy and he were side kicks and Foxy went along in an MB3 just to see what he should write home. Natcherly, they started a little combat stuff and they milled around a bit and Foxy got on his tail.

They kept on buzzin' aroun' and first thing that happened, one of H——'s ailerons came off and then the other one and next a wing and pieces then began comin' off all over the ship. H—— kept dropping faster and faster till Foxy couldn't follow him down. But he saw H—— struggle through the baby door and roll over the top, pull his 'chute, and it opened. H——'s stick had been whipping and his legs were blue and swollen. The ship hit in the backyard of a house and splattered oil all up and down the side of two nice white stories and H—— lit in the grape arbor.

Granpa told me, one day when we were feebly hoistin' the last coca cola, that every time he has a nightmare he lives through it all over again, him droppin' with the 'chute and the ship follerin' him down.

And then, there's the story of Lieut. T——, test pilot of the Boeing plant. Reports seemed to be gathering that America's pursuit plane had a tendency to disintegrate in flight. T—— naturally wouldn't take anyone else's word for it so he took the "ship" off to about five thousand and dove with a wide open engine for a thousand feet, leveled off and barreled. He just remembers flattening out and giving her the rudder. The fuselage turned over all right but the wings stood still, apparently. That was his impression, at any rate, hazy as it must have been. There he was, upside down in the fuselage with nothing left but the tail.

T—— merely undid the strap, pulled his 'chute and came down just like any good weight would. He wasn't satisfied with this but tried it again the next month—and with the same result.

And they give medals for knockin' down bosches!

N—— was a test pilot at McCook. "Was" is right. They decorated his two by six some time since. He took up one of our well known foreign monoplanes, of which we've just acquired ten or so. All we know is that he went up and started some combat work with Foxy Granpa; Granpa went into a turn and when he came out N—— was gone. They found him and the fuselage and the engine on the banks of the Miami. The wings, or pieces of them, were scattered here and there about the countryside.

Sure they sand test 'em and everything. Mathematical gymnasts and scientists and experts figure out the safety factors for dives and barrels and all that but they don't figure on what a bird can really do with a stick.

One of Granpa's stunts was to take the Baby Gax, with the new 300 Hisso, out for an airing. When he opened her up the engine jumped out, turned upside down and landed back in the bed. If it hadn't been for the armored cowl the engine would certainly have fallen through and got all bunged up.

It's a great life. Somebody in the drafting room develops a new idea but the test pilot flies it. Anything with wings comes his way and he's right there with the goods. If it'll fly at all, it *will*. The test fields get the wildest mustangs. A year and they make 'em Christians. The old time pep is gone. Test piloting is killing work, metaphorically speaking. The human body just won't stand the strain.

So much for the test pilots. It's a funny thing, this luck proposition. There was Fonda B. Johnson who was one of the men assigned to the Verville-Sperry in the Pulitzer. I say "was" advisedly for he may still be with us in the spirit. But Johnson was a "nut" on parachutes. He was also long on sand and had unlimited guts. "I've seen him at Mitchell, at Kelly—everywhere; and he was always totin' his old brown 'chute. He was in charge of pursuit tactics at the pursuit school in Texas when Mitchell was coming down for an inspection. They put it up to Johnson to put on a stunt formation—SE5's or maybe it was Spads. He takes the formation up. Every man was a competent pilot. Fonda B. says 'We will go up and you two men will do right hand rolls and I will do a reversement and come out, then you do a left-hand climbing turn and I'll do so and so. So there'll be no mistake I'll write everything down on paper.'

"Well he writes it all down on paper and we all hop off to practice our stuff. Well, the first stunt or so went O. K. and then something missed. Fonda's list said a left hand stunt turn. He signaled and then started to the right. Of course the man behind him knocked his tail off. Here was Fonda B. Johnson, the parachute fanatic of the Air Service, and he didn't have his 'chute. The other bird lost a wing. Johnson lost his tail at 2000 feet and the only other man with a complete ship followed him down to see what would happen. Fonda works on his ailerons and his engine until he gets down to fifty feet from the ground, cuts both switches, puts his arms over his head and lets the . . . . . hit and burn. That was the end of Johnson.

"It was after this that Sperry said 'I am going to make a parachute a habit.'

"You can't replace Johnson. There aren't any more like him. The same thing goes on year in and year out. Here's where we get our old 8 per cent stuff and 2 per cent incapacitated annually and here's where we want a separate promotion list," says the pilot.

Multiple Spark Plugs May Mean More Power

THE Engineering Division of the Army—more popularly speaking, McCook Field—has for the moment added to its solutions of the airplane fire annoyance and the production of better and better pursuit and other types of American airplanes, and considered the possibility of getting more of the bee-tee-you's out of gasoline.

Tests have been conducted to determine the effect of variations in the position and number of spark plugs.

At the following general conclusions there has been an arrival considering the spark set for best power in all cases:

"With detonation eliminated—

1—"There is no definite drop in power with reduction in the number of plugs until ignition is restricted to one side of the combustion chamber.

2—"There is little difference in power between intake and exhaust plug operation.

3—"The required spark advance increases as the number of plugs decreases.

"With detonation tendency—

1—"The power increases with an increase in the number of plugs.

2—"The intake plugs appear to give better power than the exhaust plugs.

3—"The spark advance for maximum power varies in general inversely as the number of plugs in operation.

4—"Greater spark advance is possible with intake than with exhaust plugs."

Tests were made with two similar types of cylinders—model W-1 of 5.5 by 6.5 bore and stroke; and model W-2 of 6.5 by 7.5 inches. These cylinders have four spark plug bosses located horizontally in the sides of the combustion chamber at 90° as shown in the illustration. They were mounted individually on the universal test engine (attached to a 100 h. p. Sprague dynamometer) and fitted with four single-cylinder Dixie magnetos, with selective switches, making possible operation with any combination of plugs. A rotary spark indicator—a revolving pointer and stationary protractor ring forming a rotary gap—was provided to indicate the actual spark setting at each condition. In all cases the spark was set at a position of maximum power.

Following are the conclusions:

Influence of the Number of Plugs

With detonation eliminated, four plugs, three plugs, and two (180°) plugs appear to give about the same m. e. p. A definite drop is obtained when two (90°) plugs or single plugs are used.

Where detonation limits the spark setting, a definite drop in m. e. p. results from a decrease from four to three plugs. The difference between three and two (180°) plugs is slight. There is a distinct drop in power effected by a change from two (180°) plugs to two (90°) plugs, but little difference between two (90°) and single plugs. In general the power is increased by an increase in the number of plugs in operation when the detonation tendency is present.

Influence of the Position

In 3-plug combinations, it makes little difference in performance whether a combination of two intake and one exhaust, or vice versa, is used.

In 2-plug combinations, any combination of one intake with one exhaust seems to show better power than two intake or two exhaust plugs. Plugs at 180° in all cases show better performance than do plugs at 90°.

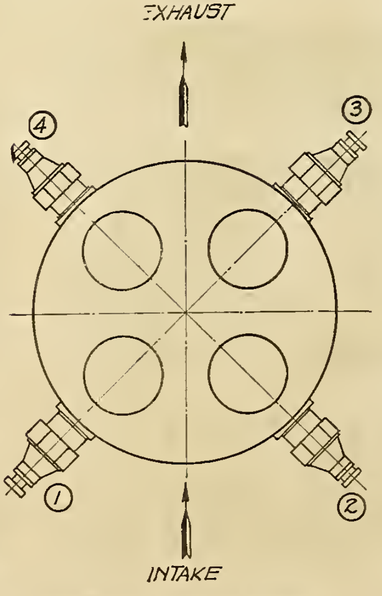


Diagram of the Location of Plugs

With detonation eliminated there is little choice between exhaust and intake pairs, but the intake plugs appear to show better power in the presence of the detonation tendency.

With single plugs, where detonation is eliminated, slightly better power was obtained with exhaust plugs. Where the spark advance is limited by detonation, however, the intake plugs give better power.

Influence of Number, Position and Detonation on Spark Advance

With detonation eliminated, the spark advance for maximum power increases as the number of plugs decreases. In the presence of detonation the spark advance for maximum power varies less definitely; in general, increasing, however, with the decrease in the number of plugs.

Variation of spark advance with the position of plugs: (a) In 3-plug combinations, under no circumstances, is there an appreciable variation of spark advance effected by a change from one intake and two exhaust plugs to one exhaust and two intake plugs. (b) In 2-plug combinations with detonation eliminated, 90° plugs appear to permit slightly more advance than do 180° plugs. In the presence of detonation, greater advance is possible with intake than with exhaust pairs of plugs and considerably more advance with 180° plugs than with 90° plugs. (c) With single plugs, without detonation, there is little difference between the advance for best power with intake and exhaust plugs. With detonation, less advance is possible with exhaust than with intake plugs.

Here is an opportunity for airplane and automobile engine manufacturers to take advantage of some of the cost of Governmental experimentation. Will it mean more power for the same weight, or a reduction in size and weight for the every-man airplane? Thus far the increase in power by use of our plugs seems to be about 2½ per cent.

Five Million Miles Through the Air

FIVE million miles through the air; this is the sum total of activities of the Air Mail Service of the Post Office Department, since its inauguration May 15, 1918 to December 31, 1922. At the present time the Air Mail Service is flying on a schedule estimated to require nearly 2,000,000 miles a year, and it is estimated that the postal planes are rapidly winging their way to the 6,000,000 mile mark.

The consolidated statement for five years of operation of the Air Mail Service just issued by Postmaster General New also reveals that the percentage performance during the whole period is 90.39, a relatively high figure. (Of the 5,281,823 miles flown up to December 31, a total of 4,623,115 miles was traveled with mail.)

The Air Mail Service since its installation has cost, the report shows, $4,295,967.69. Much of this expense has been for permanent improvements such as, repair shops, development of landing fields, and the creation of a reserve ship supply. In their flights running into millions of miles the mail pilots have carried 160,473,600 letters. That this number will increase rapidly is indicated by the fact that for last year alone planes carried more than 60,000,000 of that total.

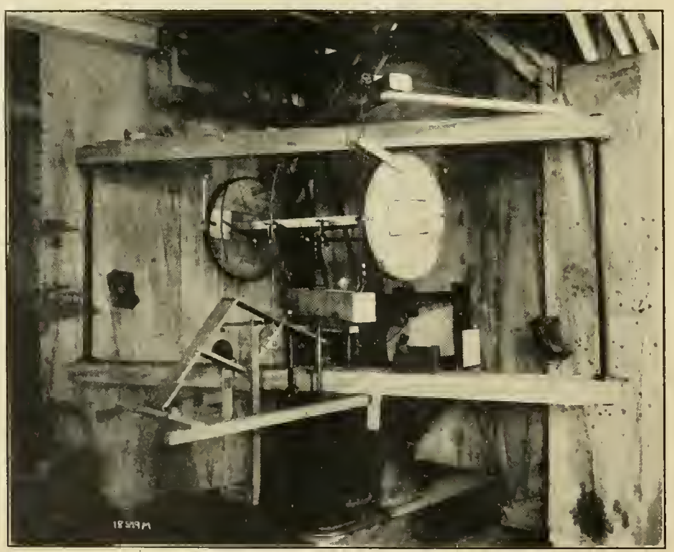
The Air Mail Service has even compiled statistics which definitely establish the fact that a mail pilot's life is not all sunshine. More than one third of the trips undertaken, 8,373, were made in rain, snow, hail or fog; 14,704 trips in five years operation were made in clear weather. Although the pilots were compelled to make 3,088 forced landings, the yearly total was cut from 1,473 in 1921 to 573 in 1922. For this record increased skill on the part of pilots and a rigid inspection system for planes, is entitled to credit.

The percentage performance is gradually creeping higher and higher as the Air Mail Service becomes established. In 1918 the percentage was 94.09, but neither this nor the year following were representative years since only the short line between New York and Washington was in operation. In 1920 when the activities were gradually spreading out and the trans-continental route was embarked upon, the performance, that is, the number of trips completed in comparison to the number scheduled, fell to 78.04 per cent. In 1921 it had risen to 92.84 per cent, and in 1922 it was 95.52 per cent. During 10 weeks of last summer the schedule was maintained 100 per cent perfect.

In addition to the trans-continental route, air mail service is now maintained between Havana, Cuba and Key West, New Orleans and Pilottown and Seattle and Vancouver. The New York-Washington route was maintained until May, 1921. St. Louis to Chicago, and the Chicago to Minneapolis runs were started in 1920 but they also were discontinued in 1921 leaving only the trans-continental service, New York, Chicago, and San Francisco, which was established September 8, 1920, in operation over land. The trans-continental route is maintained directly by the Post Office Department, while the Seattle, New Orleans, and Key West services are operated under contract.

Torsion Test Rig-Up for Universal Testing Machine

IN order to secure information for use in the design of rudder posts, elevator spars, and aileron beams for aircraft, torsion tests of such members are necessary. No torsion testing machine readily adaptable to large specimens in a variety of shapes, being available, engineers at the Forest Products Laboratory, of the Forest Service, Madison, Wisconsin, built the apparatus which is here shown mounted on a universal testing machine.



Universal testing machine developed by the Forest Products Laboratory

A specimen for test is secured in the two large disks which hold its ends, the motor is started, and the motion of the descending crosshead of the machine is transmitted to the disks by the straps attached to the short beam (shown end foremost) bolted to this head. As this movement is received by the disks it is resolved into a rotation (counterclockwise for the nearer disk and clockwise for the further one), and a downward motion of both disks with the specimen. This downward motion when measured at the center of the specimen, proceeds at half the speed of the crosshead of the machine. The pull on the disks is, by means of the supporting framework, communicated to the weighing platform on which the lower horizontal beam rests, and registered on the weighing dial of the machine.

The amount of distortion in the specimen, caused by the opposite turning of the disks, is measured by the relative rotation of the arcs fastened to it. As the specimen twists,

(*Continued on page* 282)

Note on the Determination of Longitudinal Control Forces of Airplanes During Horizontal Flight

IT IS often desired to obtain an estimate of the control forces of airplanes equipped with unbalanced elevators. The magnitude and direction of the stick force during normal flight is indicative of the stability of the ship and the ease with which it may be flown. The machine will be stable, from the pilot's standpoint, if the curve of stick force against velocity has a negative slope—a pull on the stick being taken as positive. The principal factors which govern the longitudinal control of the airplane are (1) location of the center of gravity, (2) hinge moment due to the weight of the elevators, and (3) slipstream effect on the tailplane. It is apparent that the statical moment of the elevators about the hinge cannot appreciably influence the slope of the stick force curve. In the present analysis, slipstream will be neglected.

The following additional conventions will be noted:-

1. Stalling moments are taken positive.
2. The angle of attack of the tailplane is referred to the zero lift line with neutral elevators, and is measured in the same sense as that of the wings.
3. The angular setting of the elevators is referred to the original chord line with neutral elevators. A positive elevator angle produces a decrease of pitching moment, and vice versa.
4. Hinge moments are positive if they tend to increase the angular setting of the elevator.

Now repeated tests of tailplanes show that, throughout the range of elevator angles employed during normal flight, we can represent approximately the characteristics of the tailplane by expressions of the forms:

$$C_{lt} = a\xi + b\eta \qquad (1)$$
$$C_h = a'\xi + b'\eta$$

where the lift coefficient C_l is defined by

$$C_l = \frac{L_t}{q\,S_t}$$

where L_t = lift; q = dynamic pressure corresponding to the given air speed, S_t = total tailplane area.

The hinge moment M_h due to the air load is designated by

$$C_h = \frac{M_h}{q\,S_t^{3/2}}$$

In (1) and (2) the tail angle of attack is designated by ξ and the elevator angle by η; and the a's and b's are constants. It is readily seen that (1) and (2) may be written

$$C_{lt} = a(\xi + K_1\eta) \qquad (3)$$
$$C_h = a\,K_2\,(\xi + K_3\eta) \qquad (4)$$

where $K_1 = b/a$, $K_2 = \frac{a'}{b'}$

and $K_3 = \left\{\frac{b'}{a'} - \frac{b}{a}\right\}$

The constants K_1, K_2 and K_3 depend principally upon the ratio of elevator area to total tailplane area. They are influenced to some extent, of course, by the shape of the tailplane. However, the various model and free-flight tests in this country and in England indicate that there are not very appreciable differences in the values of these constants for the same ratio of elevator area to tailplane area, for rectangular and trapezoidal forms. One would not then expect very large differences in the values of K_1, etc., with tailplanes of not too greatly different shapes; (although more tests on tail planes are certainly desirable).

In the formulas (3) and (4) the angle of attack ξ, is referred to the zero line of the section with elevators neutral. Then a is simply the slope of the lift coefficient curve of the tailplane with neutral elevators, i. e.,

$$a = \left\{\frac{\delta C_{lt}}{\delta \xi}\right\}_{\eta = 0}$$

When the slope, a, of the lift curve of the section has been determined from tests on model aerofoils, a correction for aspect ratio should be applied before substituting a in (3) and (4). The approximate aspect ratio correction to the lift curve slope is given approximately by

$$a = \frac{a_o}{\frac{57.3}{1-\pi}\left\{\frac{1}{\lambda_o} - \frac{1}{\lambda}\right\}} \qquad (5)$$

where a_o is the slope on the basis of a test on a model aerofoil of aspect ratio λ_o.

We begin the analysis for control forces by noting that

$$F = m\,(M_h + M'_h)$$

where F = control force
m = gearing of elevators
M'_h = statical hinge moment of the elevators.

The stick force is

$$F = m\,q\,S_t^{3/2}\,C_h + m\,M'_h \qquad (6)$$

or substituting the value of C_h

$$F = m\left\{q\,S_t^{3/2}\,a\,K_2\,(\xi + K_3\eta) + M'_h\right\} \qquad (7)$$

It is now only necessary to substitute the values of ξ and η. The elevator angle η is fixed by equilibrium conditions. Let the moment of the machine without the tailplane be written in the form

$$M_w = C_{mw}\,q \cdot S\,c$$

In case a model test can be made M_w is very approximately determined by testing the model for moments with and without the tailplane. If no model test can be conducted, the pitching moment due to the wings may be conveniently found by first calculating the moment about the leading edge and then transferring this moment to the desired point relative to the wing. Take the origin on the leading edge in the plane of symmetry. Then the moment about the leading edge is given by

$$M_{le} = -\frac{pc}{100}\,\frac{L\cos(\gamma - \alpha)}{\cos\gamma} \qquad (8)$$

when p = distance from leading edge to center of pressure in percent of wing chord.

c = wing chord
L = lift
$\gamma = \cot^{-1}\left\{\frac{L}{D}\right\}$
α = wing angle of attack.

The moment about any other point with co-ordinates (x y) referred to a set of axes with the origin in the leading edge (in the plane of symmetry) and with the z-axes drawn upward above the wing and the x-axes backward toward the trailing edge is

$$M_w = \frac{L\cos(\gamma - \alpha)}{\cos\gamma}\left\{x - \frac{pc}{100} - z\tan(\gamma - \alpha)\right\}$$

which gives for the moment coefficient of the wings about the center of gravity

$$C_{mw} = \frac{C_l\cos(\gamma - \alpha)}{\cos\gamma}\left\{\left\{\frac{x}{c}\right\} - \frac{p}{100} - \left\{\frac{z}{c}\right\}\tan(\gamma - \alpha)\right\} \qquad (9)$$

when the lift coefficient of the wings is defined by

$$C_l = \frac{L}{q\,S}$$

where S is the *wing* area.

If the moment coefficient C_m about the leading edge is already given then

$$C_{mw} = C_m + \frac{C_l\cos(\gamma - \alpha)}{\cos\gamma}\left\{\frac{x}{c} - \frac{z}{c}\tan(\gamma - \alpha)\right\} \qquad (10)$$

when

$$C_m = \frac{M_{le}}{q\,S_c} = -\frac{p\,C_l}{100}\,\frac{\cos(\gamma - \alpha)}{\cos\gamma}$$

The pitching moment due to the wings etc., must equilibrate that due to the tailplane. For normal flight conditions with open throttle, the thrust is nearly equal to the drag so that the moment equation is approximately

$$C_{mw}\,q\,S_c - h\,(q\,S\,C_d) - lq\,S_t\,C_{lt} = 0 \qquad (11)$$

when h = arm of propeller thrust with reference to the C. G., L the effective lever arm of the tailplane, S, the wing area, and C_d the drag coefficient for the complete airplane.

Solving (11) for C_{lt} and equating the result to (3) we find that

$$\eta = \frac{c\,C_{mw} - h\,C_d}{Q\,c\,a\,K_1} - \frac{\xi}{K_1} \qquad (12)$$

where

$$Q = \frac{l\,S_t}{c\,S}$$

For tractor types Q usually lies between 0.35 and .42, the lower figures applying to machines of the bomber or transport classes while the higher values hold for pursuit types.

The value of ξ is of course simply

$$\xi = \alpha - \epsilon + \beta$$

when β is the angular setting of the stabilizer to the wing chord, and ξ the wing downwash angle.

Then

$$\xi = \alpha\left(1 - \frac{d\epsilon}{d\alpha}\right) + \beta \qquad (13)$$

where in general $\frac{d\epsilon}{d\alpha}$ is constant and equal to about 0.55.

Next consider the conditions for a stable form of stick force curve: Neglecting slipstream, the initially independent variables may be taken as V, α, and η.

We can then write directly

$$\frac{dF}{dV} = \frac{\delta F}{\delta V} + \frac{d\alpha}{dV} \left\{ \frac{\delta F}{\delta \alpha} + \frac{\delta F}{\delta \eta} \cdot \frac{d\eta}{d\alpha} \right\} \quad (14)$$

the condition for stability being

$$\frac{dF}{dV} < O \quad (15)$$

The derivatives are found as follows:

(1) $$\frac{\delta F}{\delta V} = \frac{2q}{V} \quad \frac{\delta F}{\delta q}$$

or $$\frac{\delta F}{\delta V} = \frac{2q}{V} m S_t^{3/2} a K_2 (\xi + K_3 \eta) \quad (16)$$

where η and ξ are found from (12) and (13)

(11) $$\frac{\delta F}{\delta \alpha} = m K_1 q S_t^{3/2} a K_2 \cdot \frac{d\xi}{d\alpha}$$

$$= m K_1 q S_t^{3/2} a K_2 \left(1 - \frac{d\epsilon}{d\alpha}\right) \quad (17)$$

since

$$\frac{d\xi}{d\alpha} = \left\{ 1 - \frac{d\epsilon}{d\alpha} \right\} \quad (18)$$

(III) $$\frac{\delta F}{\delta \eta} = m q S_t^{3/2} a K_2 K_3 \quad (19)$$

(IV) The conditions of equilibrium of the airplane allow us to determine $\frac{d\alpha}{dV}$ very easily. Neglecting the small variations in lift due to changes in the elevator setting

$$dL = \frac{\delta L}{\delta \alpha} d\alpha + \frac{\delta L}{\delta V} dV = O$$

for steady horizontal flight. Hence

$$\frac{d\alpha}{dV} = - \frac{\left\{ \frac{\delta L}{\delta V} \right\}}{\left\{ \frac{\delta L}{\delta \alpha} \right\}}$$

But since

$$L = C_l q S$$

Hence

$$\frac{d\alpha}{dV} = - \frac{V \frac{2C_l}{dC_l}}{d\alpha} \quad (20)$$

(V) From equations (12) and (18)

$$\frac{d\eta}{d\alpha} = \frac{1}{Q a K_3} \left\{ \frac{dC_{mw}}{d\alpha} - \frac{h}{c} \frac{dC_d}{d\alpha} \right\} - \frac{1}{K_3} \left\{ 1 - \frac{d\epsilon}{d\alpha} \right\} \quad (21)$$

In using the formulas care must be taken to note that C_d is the absolute drag coefficient for the entire machine, defined by

$$C_d = \frac{D}{q S}$$

D being the total drag, and S the wing area.

Air Travel with Special Reference to the Helicopter

By Major F. M. Green

Lecture delivered before the Royal Aeronautical Society of Great Britain

A striking development of the present century has been the use of air travel. A new method of going from place to place has come into use which is quicker than any former means. It is only since the war that definite air services have been available to the general public, and in consequence it is only right to believe that its development is in an early and crude state. At the present moment, although there are a number of types of aircraft engaged in this work, they are all similar in principle. It is suggested from time to time that we are possibly working on wrong lines and that air travel can be carried out more effectively using machines of quite other types. The suggested alternatives to the present aeroplane are airships and another form of heavier-than-air craft generally called the "helicopter" or direct lift machine. It is not proposed in this paper to discuss the relative merits of the aeroplane and the airship, but to state some of the outstanding disadvantages of the types of aeroplane now in use and to consider whether the "helicopter" offers a hopeful solution.

Objects of Air Travel

The usual object of air travel is to go from place to place quicker than is possible by any other means. Apart altogether from its greater speed, the aeroplane saves time by travelling more directly from point to point, and by avoiding changing for sea journeys. Nevertheless, the aeroplane must be able to maintain a high speed through the air in order to make effective progress against adverse winds. Experience has shown that the slowest cruising speed that is practicable for most routes exceeds 80 miles an hour. If the route chosen is likely to be fairly free from high winds and if the existing methods of travel are very slow, a slower speed might be useful. In a general way, however, the speed must be high to make it worth while using a method of travel which for some time to come must remain expensive.

Safety

Let us agree that it is useless to run an air service with machines with a cruising speed below 80 miles an hour; we may next consider what are the desirable attributes of a machine suitable for air travel. I think that safety must be the most important attribute of any aircraft. Later on we shall consider the question of cost of running, but it cannot be doubted, even if we neglect other considerations, that an aeroplane which is not reasonably free from chances of accident is not likely to be economical in service.

Reliability

Assuming that we have an aircraft of sufficient speed and safety, the next requirement is that, when a start is made, the passenger shall be reasonably certain of reaching his destination. The value of speed disappears very rapidly if, in more than a very small percentage of cases, the journey has to be finished by other means, or if a long stoppage has to be made en route. It has been said that air travel is either the quickest or the slowest means of travel—the quickest when everything goes right and the slowest if anything goes wrong.

Closely allied to the certainty of arriving at one's destination is regularity, for a transport service is of little use unless it can be trusted to operate at regular intervals.

There must also be a certain degree of comfort, or perhaps it is better to say a minimum degree of discomfort, otherwise the number of passengers likely to use air travel must be limited.

It is scarcely possible to live in figures the actual values of the requirements mentioned, though it is clear that if we are to make air travel into an ordinary commercial undertaking we must use aircraft in which the chance of accident to a passenger is no greater than the risk by train, motor-car or boat, while the time for the journey must be less than the best achieved by any combination of these means of travel. Regularity, reliability and comfort must approach the standard of the train.

The advantages of increased speed will encourage a proportion of the ordinary travelling public to pay a higher fare which will almost certainly be needed for a number of years. How much extra they will pay must depend upon the extent to which the service possesses the qualities mentioned. In my opinion, it is unwise to concentrate entirely on reducing the cost of running the service; rather we should endeavour to encourage passenger traffic by increasing the safety, speed, regularity and reliability of the service.

If we agree with the foregoing views our attention may be chiefly directed to safety combined with a certain minimum speed, and it is chiefly from these two aspects that the present-day aeroplane and its possible developments will be considered. I know of no example of a helicopter or direct lift machine which has achieved the smallest measure of success as a means of air travel, so that the comparison between the advantages of the two types is difficult. An attempt will be made to see what chance the helicopter has of becoming a rival to the aeroplane, and in order to do this we must touch on the first principles of mechanical flight. I do not propose to go deeply into the matter in a scientific way, as the experimental work on the helicopter is limited.

First Principles

Heavier-than-air machines obtain their support from the air by giving to it a downward velocity. The momentum developed downwards of the air per second is a direct measure of the lift obtained. This applies to both aeroplane and helicopter. With the aeroplane the air is driven downwards by means of planes of suitable shape which are drawn through the air by the reaction of an airscrew. It may be said that the name airscrew is misleading, for an airscrew develops its tractive force not by screwing its way through the air (as the name seems to imply), but by projecting air backwards. Here again the reaction of the airscrew can be measured in terms of the momentum in the air displaced per second.

In the case of the helicopter the machine is sustained by projecting air downwards by means of wings or airscrews revolving in a plane which is more or less horizontal. The mechanism for obtaining support in the two cases is thus similar, but there is the wide difference that whereas the aeroplane uses the velocity of its lifting surfaces to carry it directly towards its destination, the helicopter planes or propeller blades, whichever you like to call them, have their main motion round a centre which is either fixed relative to the air or requires additional energy to move it. Diagram 1 shows this graphically—in the one case the planes of the aeroplane move from A to B in a straight line; in another they travel along a tortuous path. The energy required is roughly proportional to the length of the line joining A and B, hence it can be seen that the helicopter is at a very serious disadvantage.

Power Used for Support

The planes of a type commonly used in present-day aircraft have a ratio of lift to drag of about 15 to 1 when flying at their usual cruising speed. At 80 miles an hour in air of normal density we find that each effective horse-power spent on the planes alone corresponds to resistance of 4.7 lbs. and thus enables a weight of 71 lbs. to be supported. Taking a propeller efficiency of 75 per cent.—a figure usually obtained in practice—the weight supported per engine brake horse-power is 53 lbs. If we increase the speed of the aeroplane and use smaller planes, keeping the lift-drag ratio constant, the horse-power expended in flight will increase in direct proportion to the increased speed. This does not mean that as far as the planes are concerned more energy or more fuel will be used in travelling a given distance, but it does mean that the engine horse-power must be greater.

In the case of the helicopter it is generally understood that it is not possible to construct a direct lift airscrew that can lift nearly as much as 53 lbs. per horse-power, and if it were possible to do so the weight of the revolving planes themselves would be likely to exceed the weight lifted. The reason for this is simple—the support from the lifting screw is obtained by virtue of the downward momentum of the air in the slipstream. The air has a certain kinetic energy imparted to it which is entirely lost as far as the flying machine is concerned. The kinetic energy is proportional to the square of the velocity of the air in the slipstream, and it may be shown that to achieve a lift of 53 lbs./horse-power implies that the downward velocity must nowhere exceed 21ft./sec., and would in practice need to be less than this. This means that an airscrew to lift 1000 lbs. must have a diameter of between 30ft. and 40ft., which is scarcely practicable.

This calculation is quite elementary, and is given below.

Lift of helicopter=mass of air dealt with per second×downward velocity imparted $=Mv$.

Horse-power=kinetic energy lost per sec./550$=Mv^2/2\times550$ minimum.

$\therefore$ Lift/H.P.$=Mv/Mv^2/1100=1100/v$

M is probably not greater than pvA. where A="disc area" of helicopter.

$\therefore$ Lift$/A = Mv/A = pv^2$, $p = .00237$.

If W = weight of helicopter,

$$v = 1100/W/\text{H.P.}$$

$$\therefore W/A = .0023 \times (1100)^2/W/\text{H.P.})^2$$

$$\therefore \text{for } W = 1000$$

$d = .67\ W/$H.P. where d = diameter of helicopter in feet.

and for a lift of 53 lbs./H.P. d = 35 feet minimum.

Power Required for Flight

In order to bring the size of lifting screw to a reasonable figure we must increase the downward velocity of the air and consequently the lift in lbs./horse-power must be less. It seems, therefore, that the power required for keeping the aircraft in flight is likely to be much greater in the helicopter than in the aeroplane (see Fig. 2). The resistance of the body, landing gear, and controlling organs of the helicopter is not likely to be less than that of the aeroplane, and we may assume it to be the same. There is, however, an additional resistance due to the framework, driving mechanism and so forth of the revolving propeller blades which is likely to be greater than the resistance of the structure and wiring of the conventional aeroplane.

The effectiveness of the lifting screw will be seriously disturbed by any forward motion imparted to the helicopter, for it will mean that at one point of its rotation the propeller blade will have an additional velocity imparted to it by the forward motion of the whole machine, while at another this speed will be reduced by an equal amount. It has been proposed by many inventors to make the angle of the blades vary throughout each revolution. This, however, involves additional mechanism, and the construction of it is scarcely likely to be simple or light. In any case there will be an additional resistance to be added to the whole resistance due to the movement of the revolving propellers through the air.

From the foregoing reasons I am convinced that the power expended in flight in a helicopter, flying at speeds found to be useful for aeroplanes, will be very much greater than for the aeroplane, and I believe that, apart from all other disadvantages, this fact alone will render the machine quite impossible for passenger carrying, at any rate until engines of much less weight per horse-power and materials with much greater specific strength are available. With present-day materials it is my opinion that it is extremely unlikely that it will be possible to make a direct lift machine carrying any useful load which will be able to fly as fast as 80 miles per hour, which is the slowest cruising speed that makes flying worth while in most cases.

Safe Landing

If the conclusions of the last paragraph are correct, it seems that as a means of air travel the helicopter has little or no future, and the fact that it may be possible to rise and land in confined spaces is of little value if the ability to fly from place to place at a reasonable speed is absent. In itself, the advantage of a vertical rise and fall is unlikely to be as great as might be supposed. The difficulty of affecting a landing of a direct lift machine in a wind is certain to be great. In the ordinary aeroplane the presence of a wind helps rather than hinders matters both in getting off and alighting. The case of the helicopter is worse than that of the airship, where considerable skill is necessary to effect safe landings in a high wind.

The idea of being able to lower your flying machine to the ground by the careful working of the throttle is a pleasing one, and at first sight it seems vastly to be preferred to the aeroplane method of approaching the ground with a forward speed of 50, 60 or more miles an hour. The fact remains, however, that aeroplane pilots do not find much difficulty in landing at these speeds so long as they are not forced to alight in unexpected places. The usual reason for forced landings is, of course, the failure of the motive power, and it will be interesting to see how the helicopter compares with the aeroplane in this emergency. The aeroplane method is to glide down to the ground at a speed somewhat above the stalling speed and to use the kinetic energy of the machine to level up and fly parallel to the ground for the last few moments before alighting. So long as there is room, this method presents no difficulties. In the case of engine failure in the helicopter the situation is rather different. Neglecting all difficulties of stability and assuming that the helicopter will keep more or less on an even keel, the whole machine will descend vertically in relation to the air, and its fall will be checked chiefly by the resistance of the supporting propellers. When the engine stops the propellers will either, after stopping, be driven round in the opposite direction or they may have their pitch reversed and travel in the same direction. The terminal velocity of the whole machine unfortunately must be high as the propellers do not offer very much more resistance when spinning than when stopped.

A reference to the experiments on the resistance of an airscrew on an aeroplane will show that the increase of resistance is only of the order of 10 per cent. when it is spinning at the velocity which gives the maximum resistance, as against when it is stopped. It is possible that a specially-designed screw would have a somewhat higher resistance than this, but there seems no reason to suppose that much can be gained. The helicopter, therefore, if unchecked, will strike the ground much faster than is convenient or can be readily dealt with by even an elaborate form of shock-absorbing gear. In addition, the whole machine will be moving relative to the ground at or nearly the velocity of the wind.

There is only one means of checking the fall of the machine known to me other than by the use of parachutes. The method is similar to that used by the aeroplane pilot—the supporting propellers will be revolving at a fair speed and will have in consequence a kinetic energy in virtue of their rotation. If at the last moment the propeller blades are reversed in angle, then their kinetic energy can be used to check the fall much in the same way as is done on the aeroplane. Whether this can be considered a feasible method or not is a matter of opinion, but it is the only method which I can suggest in case of engine failure on the direct lift machine. In any case, the results with forced landings are likely to be serious, for even if the rate of fall is checked there is sure to be some forward velocity due to the wind.

Landing in Fog

Landing in fog when it is not possible to see the aerodrome, the helicopter machine certainly does appear to possess its chief advantage. On foggy days there is usually little or no wind, and it ought to be possible to allow the helicopter to descend vertically at a sufficiently slow rate to avoid serious shock, even if the ground is completely invisible. We have as yet devised no safe method of landing aeroplanes in fogs, and although there is no reason to suppose we shall not eventually manage this, it is likely to be a difficult matter and will require a great deal of organization. As is known, the usual method of landing an aeroplane is to arrange its flight path so that it approaches the ground at as small an angle as possible. The aeroplane is flown at a speed exceeding the stalling speed, and either the throttle is opened slightly near the ground or else the angle of the planes is increased and the kinetic energy of the whole machine is used to supply the power.

It is generally assumed that if the angle of an aeroplane is increased so that it flies above its stalling angle, disaster is almost certain unless there is room to dive the machine and to regain sufficient speed to fly below the stalling angle. On aeroplanes as usually made, this is to a large extent true. The controls are insufficient to enable the pilot to manage the aeroplane when flying at an angle above the stalling angle. It is as well to mention that by the stalling angle is meant that angle at which the planes exercise their maximum lift coefficient, and when any increase in angle will not increase and may decrease the total lift coefficient. There appears no reason why it should not be possible to fly at angles much above the stalling angle. This subject has been the matter of research during the past year, and it has been found possible to fly an aeroplane at angles of incidence vastly greater than the stalling angle. It seems not unlikely that in the future it will be a safe manœuvre to glide an aeroplane at an angle of incidence of as much as 45 degrees, and still maintain control. The drag of the planes will be very large, and the path of the aeroplane will be about 45 degrees to the horizontal; consequently the fuselage of the aeroplane will remain nearly horizontal. In the case of a forced landing, or a landing in the fog, it might even be possible to bring an aeroplane down to the ground at an angle of 45 degrees, in which case the forward speed will be so much reduced that the aeroplane will run a very small distance after landing; also owing to the steep angle the errors of judging distance on the ground will be very much smaller. If the engine has not broken down it will probably be possible to straighten up the machine by means of the engine and a more or less normal landing. If the engine has broken down, or if it is impossible to see the ground, then it will be necessary to provide a landing gear designed to absorb a much bigger shock than is now customary. In any case, it is almost certain that the vertical velocity on landing will be considerably lower than will be possible with an helicopter machine with the engine stopped.

Stability

Another aspect of safety is the question of stability. It is, of course, possible to make an ordinary aeroplane stable in flight, and so long as the pilot is not undertaking any severe manœuvre, such as is sometimes made necessary by engine failure, the risk of accident from loss of stability is unimportant. The stability of a direct lift machine has, I believe, never been worked out numerically. It will certainly be a matter of considerable complication, and it may be anticipated that the structural design to meet the various forces that may occur on the direct lift machine due to sudden manœuvre will vastly increase the difficulty of designing what in any case must be a somewhat complicated mechanism.

Structural Safety

From the point of view of structural safety the helicopter is likely to present grave difficulties. The aeroplane depends for its support upon a system of planes which, except for small movements of the control surfaces, are fixed. In the helicopter the equivalent of the plane structure is dependent upon a number of bearings and working joints which will certainly increase the difficulty of making a safe structure that is reasonably light.

Conclusions

The brief discussion of the problems contained in this paper is meant to represent the argument which occurred to me when considering whether or not it was worth attempting the design of a direct lift machine. It is perfectly true that there are many considerations which would prevent a private constructor starting on such an undertaking which would not, and should not, influence the minds of those directing the official policy of a country in matters of aeronautics. This private constructor must be influenced by financial considerations to a greater extent than would be the Research Department of the Ministry. At the same time, there is only a limited amount of money that can be spent on research and experiment in aeronautics. We have been informed at the last two Air Conferences that experiments on full scale have been, and are being carried out by the Air Ministry, but we have not been supplied with any details either of the way in which the experiments are being made or of the results obtained, with the sole exception that a year ago we were informed that free flight had taken place. Recently there have been rumors of large prizes offered by the Government for any machine capable of doing certain performances, which include hovering. I do not know the precise arguments which led the Air Ministry to undertake work of this description, but for the reasons given in the former part of the paper it seems to be improbable that any useful result will be obtained unless we can make vast improvements in the technique of the production of power and the making of light structures; such advances would also improve the design and performance of the ordinary aeroplane.

It will no doubt be argued that there are peculiar advantages that might be gained in war from a machine capable of hovering, but if this is so it is suggested in all seriousness that a balloon or an airship is a far more promising method of obtaining the required result. It is likely to cost less and to be safer. The object of air travel is to get from place to place, and it seems highly unlikely that the helicopter type of machine will ever afford a useful means of doing this.

Art School Prize Contest on Model Airplane Trophy

B. H. Mulvihill, of Pittsburgh, vice-president of the National Aeronautic Association of U. S. A., has announced a prize competition for art schools of $100, $50 and $25 for the three best designs for a model airplane trophy for which boys will compete at the international airplane races in St. Louis in Ocotober. The Mulvihill trophy contest at St. Louis is the first of its kind ever held and will bring together the winners of elimination contests conducted all over the country. At St. Louis the flight of the model airplane will be for distance under official observation and regulation.

"This will be known as the National Aeronautic Association design contest," said Mr. Mulvihill, "and will be open to any student of sculpture in any accredited art school and to graduates since 1921. It has been suggested that in large cities there might be local contests under the auspices of the directors of the several schools and that the three best designs be then entered for the national judging, which will be done in Washington. The models will be in clay, of course, and the awards will be based on artistic excellence and appropriateness of the subject. They must be submitted by July 15.

"Model airplanes are proving not only good sport for boys and girls, but their construction by the young fliers themselves is teaching them the principles of the power airplane. The characteristic pose of a boy launching with his hands a tiny plane lends itself to an action design for a trophy that ought to develop some very interesting and beautiful subjects."

The judging for the final awards to the three winners will be held about August 1, at National Headquarters of the Association, when the names of the successful sculptors will be announced, and photographs of the three best models issued for publication.

Proper Thought Adds Forty Miles To Speed

Four airplanes with about the same characteristics, same engines, same landing gear, same tails and one shows 40 miles better speed. Wing sections and reduction of areas of but slight effect on speed. Careful streamlining, encasing of fittings, efficient fuselage and radiator combination and suitable propeller comprise the secret of speed.

FLIGHT tests of four similar airplanes carried out at the Langley Field laboratory of the National Advisory Committee for Aeronautics to determine their relative performance with the same engine and the same air screw show:

1. A small change in wing section or wing area affects but slightly the performance.

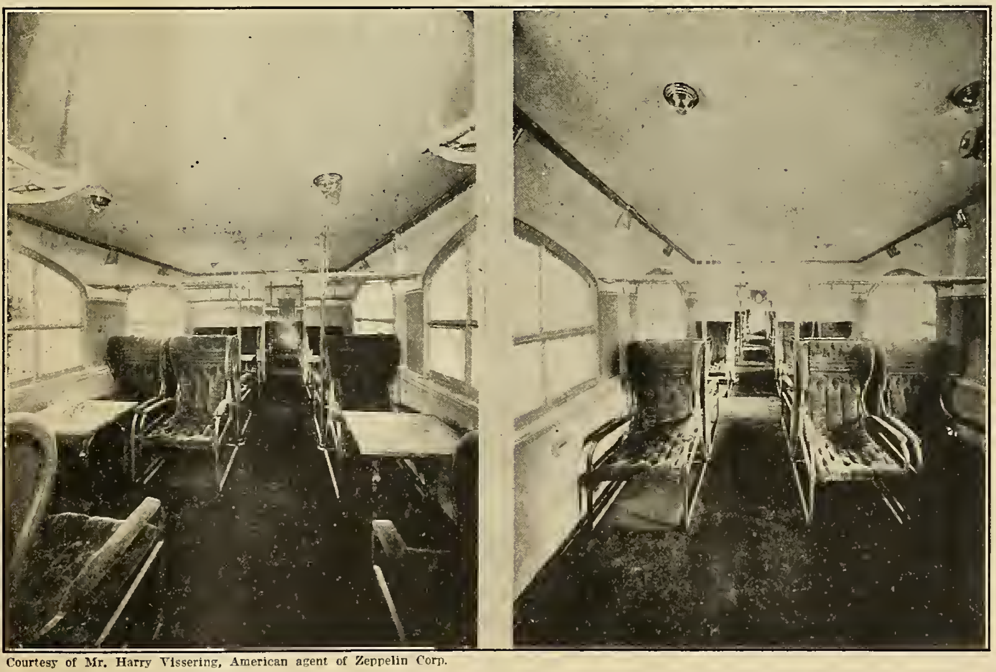
2. Changes in parts causing structural resistance have a very important effect.

The Committee has in commission three JN4hs, all varying somewhat in the type of supporting surface used, and a VE7 with the same engine and about the same weight as the others but much more carefully streamlined. In flying these airplanes it has been often observed that there is very little difference in the performance of the JN4hs whereas the VE7 shows a distinctly higher performance It was decided to carry out the seven tests listed in the chart. The two JN4hs were similar in every way. The third JN4h had 50 feet less area and the king post and overhang wires were removed. The tabulation shows the characteristics and conditions and results in speed.

All the flights were made at constant height, 2,000 feet. All speeds were corrected for density and correction was made for air speed head error. The chronometric tachometers were carefully checked and the readings are correct to within + 10 r. p. m. All the air speed instruments were calibrated and are precise to within + 1 mile per hour.

The results of the tests were plotted in the report made by F. H. Norton and W. G. Brown. Engine speeds and airplane air speeds were lotted against each other. For the three "Jenneys" with the JN air screw the curves were fairly close together, with the standard airplane quite markedly the lowest. The application of the VE7 air screw to the No. 1 JN4h gave a considerable increase in the propulsive efficiency, especially at lower speeds.

Airplane No. 4 with the JN air screw stands out distinctly from the other airplanes with an air speed for a given r. p. m. of 20-25 m. p. h. higher. This machine can fly level at slightly over 1000 r. p. m. whereas the others require at least 1200, a striking difference. When the VE7 air screw is installed on airplane No. 4, the Vought, a somewhat higher speed is obtained for the same r. p. m. up to 1,550, the limiting speed when the JN air screw is installed on airplane No. 4, never ever allows the engine to turn up 1,700 r.p.m., giving an air speed of 126 m. p. h. 40 miles faster than the maximum speed of the others. Another run was tried on the VE7 with SE5 air screw which allowed the engine to turn up to 2,100, but a speed of only 122 m. p. h. was attained.



Courtesy of Mr. Harry Vissering, American agent of Zeppelin Corp.

Airships, helium filled, not only guarantee safety; but they may be made the most comfortable aircraft known. These are passenger lounging rooms in the Zeppelin Bodenser, now in Italian hands.

Why There Is A Need For Industrial Standardization

By Albert W. Whitney

Chairman, American Engineering Standards Committee

THE need for standardization arises out of two situations. In the development of a new project the first in the field are the inventors. Of necessity they have to try out a large number of ideas; many of these prove to be useless and of those that are valuable some are better than others. Inventors are not the people to clear up the confusion in which they have left things; that is not their business, but somebody must make a selection among this confusing and unnecessary variety.

In addition the field gets unnecessarily littered up by the casual development of the business, largely through competitive influence exerted through the sales organization.

It is the job of the standardizer to take care of both of these situations; he must out of this variety select those things and those ideas that are best worth keeping.

This has two effects. It produces greater efficiency; by a reduction of the multiplicity of processes and products it allows for concentration on those that are worth while; the resulting increase in efficiency is effective all along the line, not merely in manufacturing but in selling and in buying. This is the common view of standardization and is so well understood that I need not dwell on it further.

But in addition to this, standardization does something else that is equally important. It frees the human spirit for making further advances. If there were no standardization the creators of ideas would have to be continually re-creating and would have no time for further advance. Whenever a bolt or an I-beam or a generator was needed it would have to be a matter for design. Standardization allows such needs to be taken care of through routine process and the creative spirit is relieved for fresh first-hand adventures.

Standardization instead of killing invention and initiative is the very basis upon which it rests. It is standardization that makes further invention possible.

I have had something to do with the safety movement and the situation in that field is somewhat the same. I could not feel happy at first for safety seemed to kill adventure. Its inhibitions seemed to take the snap and sparkle out of life. I could not be contented until I had thought the thing through and realized that the real aim of the safety movement was substitution and not subtraction. It substituted a real adventure for a poor adventure. It is a very stupid adventure to get ground up in a lathe or to be mangled under the wheels of a street car. The safety movement saves life for the express purpose of having a real adventure. The safety movement, therefore, is not negative but distinctly positive. I have something to do just now with getting safety education in the schools; I should go into this work with much less interest if it were not that it had this larger duty of increasing the values of life and of raising the standard of life to that of a real adventure.

Similarly I could not feel happy in the standardization movement until I came to realize that it did not produce stagnation but rather created a basis upon which to build fresh adventures in creative development.

There is a very good analogy in the development of the body and mind. To a remarkable extent both the body and mind are standardized. If our bodies were not essentially alike we could have no surgery or medicine, for a surgeon in operating for appendicitis might find a heart when he was looking for an appendix. If our minds were not essentially alike we could have no organized education; education would have to be an individual process.

The similarity of our bodies and minds affords the underlying basis on which we can construct social life and civilization and yet it is the departure from the standard which gives the touch of individuality and which not only gives the charm to our social contacts but which makes the cutting edge of progress.

There is a danger in standardization, the danger of too early standardization and too drastic standardization but there is a danger connected with the use of any powerful instrument. The problem of civilization and progress is to a very great extent a problem in the wise use of standardization.

WORLD PROGRESS in AERONAUTICS

SOVIET Russia has begun the development of a great commercial military aircraft program and occupies an important position in the international race for supremacy in the air, according to the Aeronautical Chamber of Commerce, which has made public its annual survey of aviation throughout the world.

The report, covering flying activities in 58 countries, finds France the leader of all nations in both commercial and military aviation, and still working on heavy programs. The survey of the Russian activity, however, is of unusual interest.

"Russia is using German, French and Dutch airplanes. Special aviation schools have been established at Toula, Moscow, Smolensk, Kharkow, Pola, Ekaterineslaw, Mokilaw and Petrograd. The Council of Commissaries has voted to obtain 300 new airplanes for the Red Army. It is reported authoritatively that 100 planes have been brought from Italy. In four cities the government has established domestic aircraft factories. The program for the year is to fully equip 70 fighting squadrons.

"In all, the Soviet government's program calls for 5,000 airplanes with spare parts. With the assistance of German aeronautical experts plans have been made for exploiting vast territories. Great trunk lines have been charted. It is proposed to have in operation by 1926 many thousands of aircraft. German pilots are expected to join the comparatively few Russian aviators on the commercial lines.

"France, in developing the colonial air defenses, operates a passenger and mail service three times weekly between Algiers and Biskra, another between Oran, in Western Algeria and Casablanca on the west coast of Morocco, twice weekly. During the first eleven months in 1922 the French built 3,300 airplanes for military and commercial purposes, and let orders for 1,200 additional machines. The French program for 1923 calls for 220 air squadrons, with ten machines to a squadron, or 2,200 planes with 100 per cent reserves. French air appropriations were greater in 1922 than all nations combined, aggregating $84,591,755.

"In 1922 all the French air lines operating to Africa, London, Brussels, Amsterdam, Tunis, Constantinople, Genoa and other points, in all, 14 distinct air lines, flew a total of 2,146,234 miles, carried 14,397 passengers, 1,165,216 pounds of parcels and 90,580 pounds of mail. It is planned to link all possessions from Indo-China to Guiana, through Africa and the Republic within two years. Aviation is being taught in the schools and colleges and a completely equipped French mission is making a tour of the world, and giving demonstrations in Europe, Asia, Africa and South America.

"Great Britain has centralized her aviation in the Air Ministry. Her Royal Air Force numbers 3,000 officers and 26,500 enlisted men. There are 33 squadrons—21 of them in the colonies, the Near East and India, and 12 in the British Isles. The Air Ministry employes 4,382 civilians. Approximately $54,000-000 is being spent for aviation, including $11,000,000 for construction and $2,000,000 for civilian aviation. The air estimates for the next fiscal year approximate $94,000,000.

"In Italy Premier Mussolini recently placed the air service on a par with the army and navy. Several new squadrons are being organized, and many projects for operating semi-Governmental airship service have been begun. Approximately $3,000,000 is being spent for new construction.

"In 1922 Japan appropriated $11,-304,873 for naval aviation, of which $1,586,924 is being spent for construction of new planes. About $16,000,000 is being spent on military aviation, a fourth of it for new equipment. The government is providing subsidies and liberal rewards for civilian aviation.

"German aviation, though handicapped by the treaty terms, is progressing. German engineers are active, and manufacturers of aircraft are building machines in Switzerland, Italy and Russia, and possibly in Finland and the Scandinavian countries. In addition they are most active in Asia, Soviet Russia and certain South American republics. The German Government in 1922 appropriated 22,000,000 marks in subsidies for German commercial air lines. The Hamburg-American and North German Lloyd lines are interested in several aerial projects, including both airplanes and airships. There are five other aerial operating companies. For many months they have been operating between Germany, Russia and the Baltic states, and Switzerland.

"Other countries which have relatively extensive aerial programs this year include Argentina, Australia, Belgium, Bolivia, Brazil, Canada (and all other countries in the British Commonwealth) Chile, China, Columbia, Cuba, Denmark, Holland, Ecuador, Esthonia, Finland, Honduras, Hungary, Latvia, Lithuania, Mexico, Norway, Paraguay, Peru, Poland, Portugal, Rumania, Russia, Siam, Spain, Sweden, Switzerland, Turkey, Uruguay and Venezuela.

"Mexico is spending $1,495,500 on her air service, and while the government has purchased a number of planes in the United States, it is planned to buy 200 machines in Europe during the year.

"Spain learned a lesson in the Moroccan campaign, and since then has provided a market for all European constructors. In addition to active expansion of military aviation, daily air services are being operated. A trans-Atlantic airship service is projected to be supported financially by the government."

© Official photograph U. S. Navy.

Ready For Business

Squadron of Navy Combat Planes engaged in Maneuvers over the Naval Air Station at San Diego, Cal.

An Optical Altitude Indicator for Night Landing*

By John A. C. Warner, Bureau of Standards

THAT practical commercial aviation has come to stay must be admitted by even the most skeptical. The rapid advance which the past few years have witnessed is unmistakably the forerunner of greater activity in this comparatively new field of communication and transportation. It is at once evident, however, that the greatest benefit cannot be derived from the use of aircraft as commercial carriers unless their operation can be extended over the full twenty-four hour day; for their inactivity during the hours of darkness robs them to a great extent of their advantage over the systems of ground transportation.

For this reason the problem of flying at night and under other conditions of low visibility is now demanding the attention of many aeronautical experts. We must equip our airways and aircraft with suitable means for surmounting the obstacles offered by these adverse conditions. This of course involves the installation of markers and beacons to clearly define the routes and fields, and also the equipping of aircraft with suitable instruments for navigation and landing. One of the most ingenious of the devices intended for use in night landing, especially emergency landing, is a very simple optical instrument known as the Jenkins night altitude indicator.

Referring to fig. 1, we note three projectors: A, B, and C, each of which is equipped with an incandescent lamp properly mounted at the upper extremity to project a beam of light downward through the tube to the ground or water upon which a landing is to be made. Two of these projectors: B and C, are attached rigidly and parallel to each other to the side of the aircraft, while the third, A, is made rotatable (upon rails D and E) through a certain angle in a plane parallel to the fore-and-aft-axis of the ship. Motion of A is brought about by the aviator who manipulates a handwheel operating through a pinion mating with rack F.

Projectors B and C are each equipped with an object screen which provides a characteristic image on the landing surface; as shown in Figs. 2 and 3, a rectangular bar is projected by B and two blunt arrowheads by C. The ground image from A is the altitude figure representing the particular altitude for which the projector is set.

In determining the altitude of the aircraft the pilot simply turns the wheel attached to the pinion mating with rack F until the light-beam from A intersects that from C at the landing surface. As A rotates, a toothed metal disc G attached to A and extending through the walls of the projector tube into the light-beam is caused to rotate in a definite manner by virtue of the action between the teeth of G and those of the fixed rack with which they engage. The rotating disc acts as a rotatable object screen, for it is pierced by openings in the form of the altitude numerals corresponding to the particular setting of the projector. Thus it is that the image seen upon the landing surface between the arrowheads projected by C is that of the altitude numerals cut in G, through which the light passes.

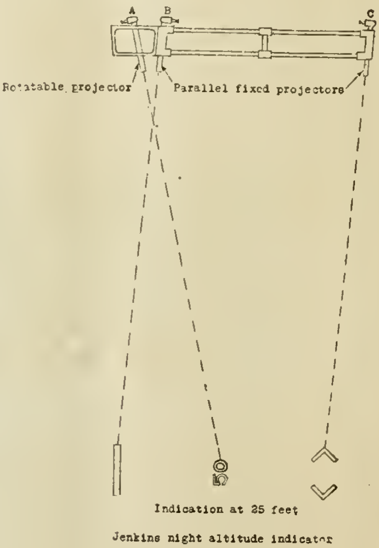


Fig. 2

The altitude may also be observed on the transparent scale H, for an opening in the case containing the illuminating element of A allows a beam of light to fall upon the scale graduation which corresponds to the particular setting of the projector at which the ground images are seen to meet. The intersecting beams (from A and C) form two sides of a triangle whose altitude, determined with the instrument, is also that of the aircraft above the landing surface.

Inasmuch as 50 feet is the lowest direct indication of altitude for the instrument described, the illuminated bar image projected by the fixed

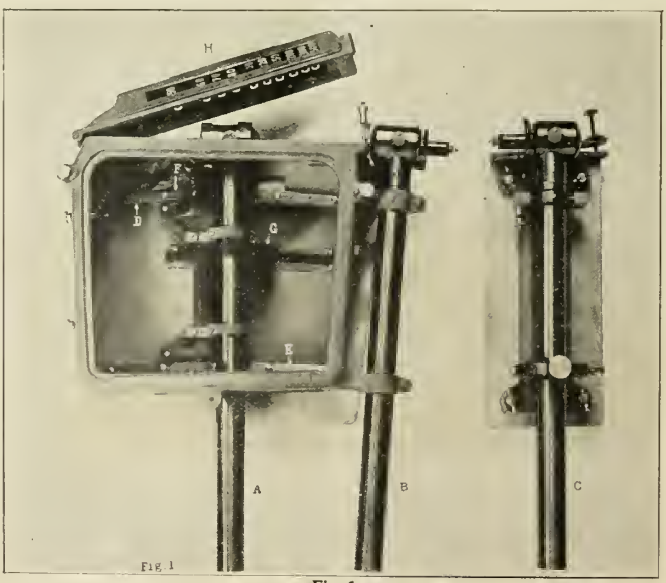


Fig 1

source B is employed in estimating altitudes of less than 50 feet. It will be seen that as the aircraft approaches the ground with all three projectors stationary, the numeral "50" will move from the arrowheads toward the bar image. The prevailing altitude is then estimated by observing the position of the altitude image with respect to the bar and arrowheads. For example, an altitude of 25 feet would be indicated when the numerals were observed midway between the other two images as shown by fig. 2. The maximum direct indication of the instrument is 500 feet (see Fig. 3).

The night altitude indicator described has been used in Great Britain.

Tests of the instrument conducted in this country have shown satisfactory results. *

The Germans have developed several types very similar in principle to the Jenkins' device. One of the most interesting of these involves the projection of a beam downward and forward from a light-source fixed to the tail of the aircraft. Diffusely reflected rays are in turn thrown upward from the landing surface and pass through an optical arrangement in the cockpit where the pilot may observe his altitude by noting the position of a spot of light against a transparent scale.

Ground images

of

Jenkins night altitude indicator.

Fig. 3.

Various possible modifications and improvements of the above instruments are readily apparent. For example, the Jenkins' indicator might be simplified by omitting the second projector (B) whose advantages are of doubtful importance; for at altitudes below 50 feet a pilot would generally prefer to watch the landing area ahead of him rather than to observe the ground images and estimate their relative positions.

Further simplification might be effected by having both projectors (A and C) fixed to the aircraft in definite positions. In this case the beams of light would intersect at the landing surface for only the one chosen altitude to which the arrangement had been adjusted. Other altitudes might be estimated by noting the separation of the images. For such purposes it would be desirable to have the projected images characteristic of their source; otherwise difficulty would arise in readily determining whether the forward or aft image was leading.

To the writer's knowledge no tests have been conducted in this country to determine the characteristics of the German adaptations as mentioned above. However, one might reasonably doubt the feasibility under all conditions of using the diffusely reflected rays from a landing surface for other than direct observations.

*Technical Note No. 123 of N. A. C. A.
*Bureau of Standards tests conducted in flight and in the laboratory by A. H. Mears and J. B. Peterson.

The Costanzi Multimanograph

THE discussion of various methods for measuring the forces acting on the various members making up the structure of an airplane in flight has been going on during the last seven years. Various methods have been suggested and tried, a number of more or less empirical formulae have been developed and safety factors varying between 5 and 15 and even as high as 21 have been adopted in the design of modern aircraft.

In spite, however of carefully made static tests we have had a number of cases when aircraft have broken up in flight while making a turn or in the performance of acrobatic stunts. Under these conditions, quite evidently, the distribution and the magnitude of the dynamic load on wings and other parts of an airplane are quite different from those prevailing in sand loading and other static tests on the ground.

An instrument which would register the variation and the magnitude of the forces acting on various points of an airplane in flight under any flying conditions has been needed

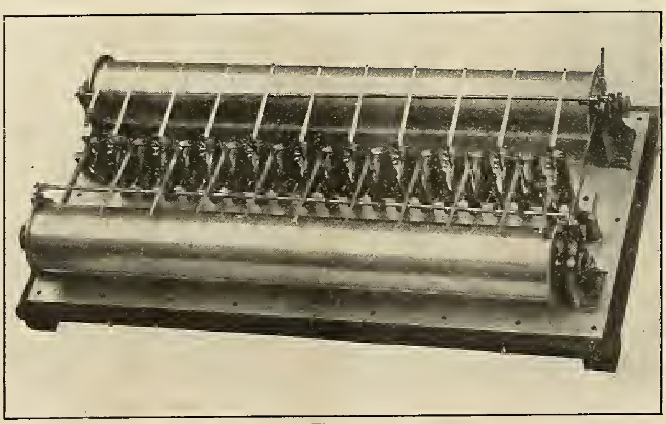


Fig. 1

ever since flying was started. An instrument of this nature was developed by Col. G. Costanzi of the Italian Army, while he was the Director of the Experimental Division of Aeronautics in Rome, Italy. Details of this instrument have never been published, and we are indebted to Col. Costanzi for being able to present to the readers of Aerial Age a description of this apparatus.

The principle on which the instrument was designed is very simple, and the instrument itself consists of a battery of twenty-one very sensitive manometric capsuls (fig. 1). Each one of these units has a diameter of 50 m.m.; the diaphragm is made of a special alloy .05 m.m. thick, undulated surface and is fixed to a wooden base through a support consisting of a tube through which the air is admitted. Rubber tubes attached at one end to one of the manometers and leading it to the other end, through the wings or through the body of the airplane to any desired spot on the wings, control planes, or tail of the airplane, allow the air pressure at various points of an airplane in flight to act upon the diaphragms of the twenty-one manometers.

The twenty-one manometers of the Costanzi Multimanograph, as the instrument is called, are arranged on two rows of ten and eleven manometric units respectively. The tubes of all units are all connected with a single faucet located in the cockpit in front of the pilot and which is designed so that when the instrument is not working all the manometers register the still air pressure at a convenient spot at the interior of the fuselage. When the instrument is put in operation, the twenty-one manometers start operating simultaneously at once.

Attached to the diaphragm of each manometer, a registering device reproduces graphically on two rotating cylinders the amplitude (conveniently amplified through a system of levers) of every axial displacement of the center of the diaphragm. In this way twenty-one records of the variation of air pressure in as many points of the aircraft are simultaneously obtained on the paper wrapped around the two cylinders mentioned above.

These two cylinders are 510 m.m. long, and make a complete rotation in two minutes, under the action of two cronometric electro magnetos and are automatically stopped when the registering devices of the manometers are lifted all at once from the cylinder and the Multimanograph is not working.

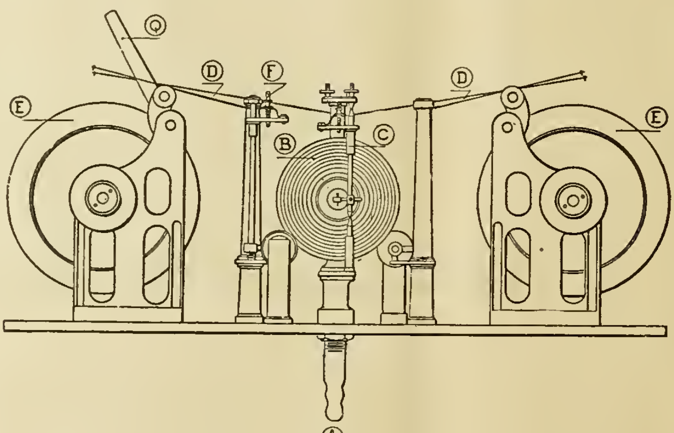
It is advisable to connect in so far as it is possible all the manometers in a row with those points where pressures are expected and the manometers of the other row with points where air depressions are to be measured.

Every manometer is perfectly balanced under the influence of the inertia forces acting upon its component parts in flight. The maximum air pressure or depression that can be registered by each manometer is equal to 25 m.m. of mercury.

The Costanzi Multigraph was built in 1919 and has since been tried on a S. V. A. airplane with very gratifying results. Due however, to the many changes which have taken place after the war in the ever changing organization of Italian aeronautical services, the tests have not been continued, in spite of the very satisfactory results obtained.

It is expected however that the new Italian government which seems to be willing to take aeronautics seriously will soon discover once more the Multimanograph which supplies a much needed instrument for obtaining some real information about the actual forces acting on an aircraft in flight.

This knowledge is sorely needed, if safety factors in airplane design are supposed to have a real meaning instead of the theoretical meaning that they have now.



Aerological Aid for Aviators

THE United States Weather Bureau is anxious—and so is every one else interested in seeing aviation, and aerostation when we get it, go forward with the greatest possible speed and with the full utilization of all the aids that are available—to have pilots of the country take full charge of its forecasts, warnings and information.

Service Now Furnishes Government Aviators

Every Army and Navy aircraft station has been thoroughly informed of the aid the Weather Bureau can give. All these stations have been supplied with maps showing the locations of existing Weather Bureau stations. Each of these stations is marked on the map by characteristic signs to indicate whether it has (1) facilities for surface observation only, (2) those capable of making surface and upper air observations by means of pilot balloons, (3) those having, in addition to pilot balloon observation, upper air observation with instrument-carrying kites and (4) those which are District Forecast Centers and prepared to give weather conditions and forecast for more extended areas than other stations.

In addition to these markings, certain stations are marked to indicate installations by the meteorological section of the Signal Corps of the Army, with pilot balloon observation. These in the main, are Army Air Service stations. Those of the Navy with similar features are also marked.

Around the location on the map of any one station there is drawn on the copy sent that station a large circle representing the territory within a radius of 300 miles. Each Army or Navy or other activity at the center of this circle is expected to cooperate with the Weather Bureau stations enclosed. Where the circle of another Army Air Service organization which is less than 600 miles away overlaps this circle a division is made as to the cooperation with the stations within the radius from both activities, and the Chief of Air Service makes the division and furnishes a list in a corner of the map of the Weather Bureau stations to be worked with.

Air Service pilots in these various areas have been instructed by the C. A. S. to make flying trips to the Bureau's stations, meet the personnel, study the possibilities and limitations of aerology and at the same time locate and inspect such landing fields as may be over-flown in the course of these visits. Weather Bureau officials are asked to lecture to the pilots.

Similar instructions have been given Navy personnel.

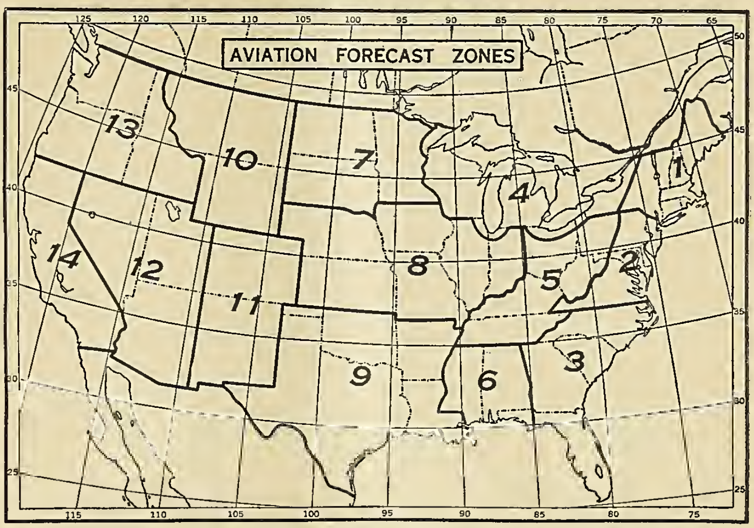
Air Service stations, when flying operations are carried on, are expected to call certan Weather Bureau offices at 9:30 a. m. and 9:30 p. m., eastern time to obtain information on the actual weather conditions prevailing at 8 a. m. and 8 p. m., eastern time, all over the country, which information is wired by the Weather Bureau to all its stations. Any Weather Bureau station will, upon receipt of a prepaid telegram from an Army or Navy flyer away from his station, requesting information as to prevailing and expected weather conditions in a particular section, furnish the information by prepaid wire in return, the Weather Bureau standing half the expense.

Service to the Public

The Weather Bureau will furnish any flying organization or individual pilot similar weather information by telegram collect upon receipt of prepaid telegram.

Flying forecasts for the fourteen aeronautic forecast zones (fig. 1) of the United States, covering the country east of the Mississippi River,

U. S. DEPARTMENT OF AGRICULTURE,
WEATHER BUREAU.



Forecasts of weather conditions and of wind at surface and aloft are issued twice daily for the benefit of aviators. They are made at 9:30 a. m. and 9:30 p. m. (75th meridian time), and cover a period of 12 hours, beginning at noon and midnight, respectively.

The forecasts for the varions zones are prepared and issued from forecast centers of the Weather Bureau as follows:
Washington, D. C.: Zones 1, 2, 3, 5, 6, 9, and 11.
Chicago, Ill.: Zones 4, 7, 8, and 10.
San Francisco, Calif.: Zones 12, 13, and 14.

are broadcasted from the Navy radio station at Arlington, Va., at 10:30 a. m. and 10 p. m., eastern time. The night forecast covers weather conditions in the zone until noon of the following day; the morning forecast covers weather conditions in the various zones from noon until midnight of the same day.

The Washington Post and the Washington Herald publish each morning a special forecast furnished them by the Weather Bureau for routes from Washington, D. C., to Norfolk, Va., and from Washington to New York and from Washington to Dayton, Ohio.

Here is an opportunity for aero clubs in various cities where there is considerable flying to obtain the support and interest of the local newspapers.

The six aeronautic forecast zones are illustrated in Fig 1.

Table I is a list of Weather Bureau stations arranged by the 600-mile circle system of the Army Air Service. These are numbered to indicate their character, as outlined in the second paragraph of this article.

In addition to these Weather Bureau stations arranged under the Army Air Service system, there are given, in Table II, a complete list of Weather Bureau stations prepared to furnish weather data.

List Weather Bureau Stations

Abilene, Tex.
Albany, N. Y.
Alpena, Mich.
Amarillo, Tex.
Anniston, Ala.
Apalachicola, Fla.
Asheville, N. C.
Atlanta, Ga.*
Atlantic City, N. J.
Augusta, Ga.
Baker, Oreg.
Baltimore, Md.*
Binghamton, N. Y.
Birmingham, Ala.
Bismarck, N. Dak.*
Block Island, R. I.
Boise, Idaho *
Boston, Mass.*
3-Broken Arrow, Okla.†
Brownsville, Tex.
Buffalo, N. Y.
2-Burlington, Vt.
Cairo, Ill.
Canton, N. Y.
Cape Henry, Va.
Cape May, N. J.
Charles City, Iowa.
Charleston, S. C.
Charlotte, N. C.
Chattanooga, Tenn.
Cheyenne, Wyo.*
4-*Chicago, Ill.*
Cincinnati, Ohio
Cleveland, Ohio.
Columbia, Mo.*
Columbia, S. C.*
Columbus, Ohio.*
Concord, N. H.
Concordia, Kans.
Corpus Christi, Tex.
Dallas, Tex.
Davenport, Iowa.
Dayton, Ohio.
Del Rio, Tex.
2, 4—*Denver, Colo.**
Des Moines, Iowa.*
Detroit, Mich.
Devils Lake, N. D.

Mobile, Ala.
Modena, Utah.
Montgomery, Ala.*
Moorhead, Minn.
Nantucket, Mass.
Nashville, Tenn.*
New Haven, Conn.
4-*New Orleans, La.**
New York, N. Y.
Norfolk, Va.
Northfield, Vt.
North Head, Wash. (P. O. Ilwaco, Wash.)
North Platte, Nebr.
Oklahoma City, Okla.*
Omaha, Nebr.
Oswego, N. Y.
Palestine, Tex.
Parkersburg, W. Va.*
Pensacola, Fla.
Peoria, Ill.
Philadelphia, Pa.*
Phoenix, Ariz.*
Pierre, S. Dak.
Pittsburgh, Pa.
Pocatello, Idaho.
Point Reyes, Calif. (Through San Francisco Sta.)
Port Angeles, Wash.
Port Arthur, Tex.
Port Huron, Mich.
Portland, Me.
Portland, Oreg.*
Providence, R. I.
Pueblo, Colo.
Raleigh, N. C.*
Rapid City, S. Dak.
Reading, Pa.
Red Bluff, Calif.
Reno, Nev.*
Richmond, Va.
Rochester, N. Y.
Roseburg, Oreg.
Roswell, N. Mex.

Dak.
Dodge City, Kans.
3-Drexel, Nebr.†
(P. O. Washington, Nebr.)
Dubuque, Iowa.
Due West, S. C.†
Duluth, Minn.

Eastport, Me.
Elkins, W. Va.
Ellendale, N. Dak.†
El Paso, Tex.
Erie, Pa.
Escanaba, Mich.
Eureka, Calif.
Evansville, Ind.

Fort Smith, Ark.
Fort Wayne, Ind.
Fort Worth, Tex.
Fresno, Calif.

Galveston, Tex.
Grand Haven, Mich.
Grand Junction, Colo.
3-Royal Center, Ind.†
Sacramento, Calif.
Saginaw, Mich.
St. Joseph, Mo.
St. Louis, Mo.
St. Paul, Minn.
Salt Lake City, Utah.*
San Antonio, Tex.
San Diego, Calif.
Sand Key, Fla. (Through Key West Sta.)
Sandusky, Ohio.
Sandy Hook, N. J. (P. O. Fort Hancock, N. J.)
2, 4—*San Francisco, Calif.**
San Jose, Calif.
San Juan, Porto Rico, W. I.*
San Luis Obispo, Calif.
Santa Fe, N. Mex.*
Grand Rapids, Mich.
Green Bay, Wis.
Greenville, S. C.
3-Groesbeck, Tex.†

Hannibal, Mo.
Harrisburg, Pa.
Hartford, Conn.
Hatteras, N. C.
Havre, Mont.
Hawaiian Volcano Observatory. (P. O. Volcano House, Hawaii.)
Helena, Mont.*
Honolulu, Hawaii*
Houghton, Mich.
Houston, Tex.*
Huron, S. Dak.*

Independence, Calif.
Indianapolis, Ind.*
Iola, Kans.
2-Ithaca, N. Y.*

Jacksonville, Fla.*
Juneau, Alaska*
Sault Sainte Marie, Mich.
Savannah, Ga.
Scranton, Pa.
Seattle, Wash.*
Sheridan, Wyo.
Shreveport, La.
Sioux City, Iowa.
Spokane, Wash.
Springfield, Ill.*
Springfield, Mo.
Syracuse, N. Y.

Tacoma, Wash.
Tampa, Fla.
Tatoosh Island, Wash.
Taylor, Tex.
Terre Haute, Ind.
Thomasville, Ga.
Toledo, Ohio.
Tonopah, Nev.
Topeka, Kans.*
Trenton, N. J.*

Valentine, Nebr.
Vicksburg, Miss.*
Kalispell, Mont.
Kansas City, Mo.
Keokuk, Iowa
Key West, Fla.
Knoxville, Tenn.

La Crosse, Wis.
Lander, Wyo.
2-Lansing, Mich.*
Lewiston, Idaho.
Lexington, Ky.
Lincoln, Nebr.*
Little Rock, Ark.*
Los Angeles, Calif.
Louisville, Ky.*
Ludington, Mich.
Lynchburg, Va.

Macon, Ga.
2-Madison, Wis.
Manteo, N. C.
Marquette, Mich.
Memphis, Tenn.
Meridian, Miss.
Miami, Fla.
Miles City, Mont.
Milwaukee, Wis.*
Minneapolis, Minn.*
Wagon Wheel Gap, Colo.‡ (Through Denver Sta.)
Walla, Walla, Wash.
2, 4—*Washington, D. C.*
Wausau, Wis.
Wichita, Kans.
Williston, N. Dak.
Wilmington, N. C.
Winnemucca, Nev.
Wytheville, Va.
Yankton, S. Dak.
Yellowstone Park, Wyo.
Yuma, Ariz.
Repair Stations (Under supervision of Port Angeles, Wash.)
Clallam Bay, Wash.
Neah Bay, Wash.
Sekiou, Wash.§ (Through Port Angeles Sta.)
Twin, Wash.

Table I

McCook Field, Dayton, Ohio.
Dayton, Ohio.
Port Huron, Mich.
Saginaw, Mich.
2-Lansing, Mich.
Detroit, Mich.
Sandusky, Ohio.
Cincinnati, Ohio.
Columbus, Ohio.
Toledo, Ohio.
Cleveland, Ohio.
Parkersburg, W. Va.
Fort Wayne, Ind.

Bolling Field, Anacostia, D. C.
2-4 Washington, D. C.
Pittsburgh, Pa.
Elkins, W. Va.
Dahlgren, Va.

Rockwell Field, Coronado, Calif.
San Diego, Calif.
Phoenix, Ariz.
Yuma, Ariz.

Godman Field, Camp Knox, Ky.
Louisville, Ky.

Mather Field, Sacramento, Calif.
Sacramento, Calif.
Eureka, Calif.
Red Bluff, Calif.
Reno, Nev.
Winnemucca, Nev.

Ellington, Field, Houston, Tex.
Houston, Tex.
Dallas, Tex.
Forth Worth, Tex.
Palestine, Tex.
Groesbeck, Tex.
Galveston, Tex.
Port Arthur, Tex.
Shreveport, La.

Post Field, Fort Sill, Okla.
Oklahoma City, Okla.
Amarillo, Tex.
3-Broken Arrow, Okla.
Fort Smith, Ark.
Wichita, Kans.

Fort Riley, Kans.
Topeka, Kans.
2-4 Denver, Colo.
Pueblo, Colo.
Lexington, Ky.
Indianapolis, Ind.
Evansville, Ind.
Cairo, Ill.
Nashville, Tenn.
Knoxville, Tenn.

Pope Field, Camp Bragg, Fayetteville, N. C.
Raleigh, N. C.
Lynchburg, Va.
Wytheville, Va.
Charlotte, N. C.
Asheville, N. C.
Wilmington, N. C.
Columbia, S. C.
Charleston, S. C.

Aberdeen Proving Ground, Aberdeen, Md.
Baltimore, Md.
Buffalo, N. Y.
Erie, Pa.
Harrisburg, Pa.
Reading, Pa.
Philadelphia, Pa.
Atlantic City, N. J.
Cape May, N. J.

Carlstrom Field, Arcadia, Fla.
Tampa, Fla.
Dodge City, Kans.
Concordia, Kans.
Iola, Kans.
North Platte, Nebr.
Omaha, Nebr.
3-Drexel, Nebr.
Lincoln, Nebr.

Kelly Field, San Antonio, Tex.
San Antonio, Tex.
Corpus Christi, Tex.
Taylor, Tex.
Del Rio, Tex.
Abilene, Tex.

Fort Bliss, Tex.
El Paso, Tex.
Santa Fe, N. Mex.
Roswell, N. Mex.

Chanute Field, Rantoul, Ill.
Peoria, Ill.
4-Chicago, Ill.
Springfield, Ill.
Hannibal, Mo.
Columbia, Mo.
St. Louis, Mo.
3-Royal Center, Ind.
Terre Haute, Ind.
Green Bay, Wis.
La Crosse, Wis.
2-Madison, Wis.
Miami, Fla.

March Field, Riverside, Calif.
Los Angeles, Calif.
Tonopah, Nev.
Independence, Calif.

Fort Benning, Ga.
Macon, Ga.
Atlanta, Ga.
Augusta, Ga.
Savannah, Ga.
Thomasville, Ga.
Greenville, S. C.
Columbia, S. C.
Charleston, S. C.
Anniston, Ala.
Birmingham, Ala.
Montgomery, Ala.
Mobile, Ala.
Meridian, Miss.
Pensacola, Fla.
Chattanooga, Tenn.

Crissy Field, San Francisco, Calif.
2-4 San Francisco, Calif.
Fresno, Calif.
Milwaukee, Wis.
Des Moines, Iowa.
Dubuque, Iowa.
Davenport, Iowa.
Keokuk, Iowa.

Mitchell Field, Garden City, L. I., N. Y.
Portland, Me.
2-Burlington, Vt.
Northfield, Vt.
Boston, Mass.
Providence, R. I.
Hartford, Conn.
New Haven, Conn.
Nantucket, Mass.
Canton, N. Y.
Oswego, N. Y.
Syracuse, N. Y.
Rochester, N. Y.
Albany, N. Y.
2-Ithaca, N. Y.
Binghamton, N. Y.
Scranton, Pa.

Langley Field, Hampton, Va.
Cape Henry, Va.
Norfolk, Va.
Manteo, N. C.
Hatteras, N. C.

Forecast centers in italics.
*Climatological section center. †Aerological station. ‡Forest Experiment station; maintained in cooperation with Forest Service.
§Closed from April to October, inclusive.

Official Regulations Governing British Helicopter Competition

FOLLOWING are the official regulations governing the competition for prizes amounting to £50,000 offered by the British Air Ministry:

The Air Council have decided, as announced by the Secretary of State for Air, to offer prizes amounting to £50,000, for the successful completion of certain flying tests applicable to a helicopter or equivalent type of flying machine.

The conditions of entry and the tests to be carried out are as follows:

1. The Air Council will subject to and in accordance with the Conditions of the Competition award prizes amounting to the sum of£50,-

000 in connection with the production of a flying machine which carries out independently of the existence of any bouyant structure or of power or assistance supplied from any source external to the machine and to the satisfaction of the Judging Committee appointed by the Air Council the tests specified in Condition 4.

2. All entries by persons intending to enter flying machines for the competition must be sent to the Secretary, Air Ministry, before 30th April, 1924. No entry received after 30th April, 1924 will be accepted.

3. Flying machines when undertaking the tests named in Condition 4 will be required to carry a pilot, sufficient fuel for one hour's flight and 150 pounds of military load.

4. The following are the tests to be undertaken by flying machines entered for the competition.

Test (a) The flying machine must make —

(I) In a ground wind not exceeding five miles per hour, and

(II) In a ground wind exceeding ten miles per hour, but not exceeding 20 miles per hour

a vertical flight from a position of rest on the ground to a height of 2,000 feet and descend and land without damage.

Test (b) The flying machine must make in a ground wind not less than five miles per hour and not exceeding twenty miles per hour a vertical flight from a position of rest on the ground to a height of 2,000 feet and remain in the air at an altitude of 2,000 feet for half an hour in a stable attitude over a ground area determined by the Judging Committee and thereafter descend and land without damage.

Test (c) The flying machine must make a vertical flight from a position of rest on the ground to a height of 2,000 feet and must fly over a prescribed closed circuit of not less than 20 miles in length at an approximate constant height of not less than 2,000 feet, and at an air speed of not less than 60 miles per hour and thereafter descend and land without damage.

Test (d) The flying machine must make in a ground wind not less than five miles per hour or exceeding 20 miles per hour a vertical flight from a position of rest and be manoeuvred while in the air over a given ground point as directed by the Judging Committee and must descend vertically from a height of not less than 500 feet without engine, and alight without damage within a confined circular area on the ground having a radius of 100 feet and the given ground point as centre.

5. The term Vertical Flight in paragraph 4 means a flight executed from the starting point without appreciable divergence from a vertical line passing through such starting point.

6. A separate entry must be sent in respect of each flying machine intended to be entered for the competition. The Air Council reserve the right to refuse any entry sent in.

7. Entries must be made by the owner or owners of the flying machine upon the form of entry provided by the Air Council, and must state the name, address, profession and nationality of the owner or owners and the names, addresses and nationality of any person or persons having an interest in the machine.

8. Entrants will be required as a condition of the acceptance by the Air Council of the entry to furnish the Air Council with their written acceptance of the conditions of the competition together with the written consent to the entry and acceptance of the Conditions of the Competition of any person or persons having an interest in the flying machine entered.

9. Entrants must also if called upon to do so furnish the Air Council with such further document declaration or other evidence as the Air Council may require to satisfy them that the entry is made with the consent of any person or persons having an interest in the flying machine entered and that such person or persons accept and agree to be bound by the Conditions of the Competition.

10. The Air Council reserve the right to add to or alter any of the conditions of the Competition other than the tests to be undertaken by flying machines and the amounts of the prizes to be awarded for each test.

11. Each entrant must at the time of entry furnish particulars of all patents which have been applied for or granted and of all designs for which registration has been applied for or granted in respect of inventions or designs embodied or made use of in or in connection with the flying machine entered.

12. Each entrant must at the time of entry furnish the Air Council with a description and general arrangement drawings of the flying machine entered and must give such further information in regard thereto as may be required by the Air Council, and at the conclusion of any test named in Condition 4 the Air Council or any person or persons appointed by them shall be at liberty to examine any flying machine which has undergone the test and to take records for the use of the Air Ministry of such measurements, particulars and details as may be desired and the entrant, his servants and agents shall afford all reasonable facilities and assistance for the purpose.

13. The Air Council will in due course after the date on which entries close proceed with the tests of flying machines which have been entered for the competition and will notify entrants of the time and place appointed for tests of the machines entered by them but no time and place will be notified to the entrant of any machine and no test of any machine will be held until all the conditions of the Competition required to be fulfilled by the entrant of such machine have been complied with.

14. In the event of any one of the four tests named in Condition 4 not having been held in respect of any flying machine entered for the Competition within a period of 12 months from the date on which entries close such machine shall be deemed to be withdrawn from the Competition by the entrant as respects any test or tests which have not then been held in respect of the machine and the machine shall be disqualified from competing further for any prize other than the prize or prizes (if any) allocated under Condition 19 in respect of the test or tests which the machine has carried out.

15. The tests named in Condition 4 will be carried out under the control and direction of the Judging Committee appointed by the Air Council and the Judging Committee may make such rules with regard to the conduct and carrying out of the tests or any of them (including disqualification of competing machines) as they may think necessary. All instructions given to entrants or their servants or agents by the Judging Committee and all rules made by them will be duly observed by entrants and their servants or agents.

16. The decision of the Judging Committee appointed by the Air Council on any matter connected with the tests or the allocation of the prizes and the decision of the Air Council on any other matter connected with or arising out of the Competition shall be final and without appeal.

17. No application by entrants for financial assistance from public funds will be entertained by the Air Council who will undertake no responsibility in respect of any expenses incurred by entrants in connection with the design, construction, transport or test of flying machines entered by them. All such expenses (including travelling and other expenses of the Judging Committee appointed by the Air

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SPEAKING as a member of the International Aerial Convention that took place in London recently, Sir Sefton Brancker said:

"There is a spirit about aviation which tends to cooperation instead of eternal bickering and fighting over small points. There is more natural trust and cooperation between nations in aviation than on any other matter and I am not at all sure that the International Air Convention of October 1919, will not be one of the biggest weapons for peace of the League of Nations."

We entirely agree with General Brancker's views regarding the spirit of international cooperation that is prevalent in aeronautics in every country except our own. As a matter of fact the United States was one of the signers of the Air-Convention of 1919, but that convention was never ratified by the Congress of the United States. The reason why it was not ratified was that the air convention of 1919 led to the establishment of the "Commission Internationale de Navigation Aerienne" (C. I. N. A.), which, according to Article 34 of the Convention is placed under the direction of the League of Nations.

The C. I. N. A. is an international organization in which fifteen governments are represented. The seat of this organization is in Paris. The governing body is in Geneva at the headquarters of the League of Nations. It is managed by a General Secretary, Mr. Albert Roper, a Frenchman formerly attached to the General Staff of Marshall Foch, and by two secretaries, Mr. Boulanger, a Frenchman and M. Peverell an Englishman.

The C. I. N. A. is an Official International Commission interested mainly in the international political aspect of aerial navigation, which however, has the power to formulate and to bring about the adoption of laws and regulations on commercial aeronautics which some day may prove very embarrassing indeed to these countries that have elected to stay out of the C. I. N. A.

As far as we are concerned, we are out of the C. I. N. A. and we will probably keep out of any commission, league or tribunal exercising super-governmental rights over this country. We cannot, however, ignore the fact that commercial aeronautics has an international as well as a national aspect. Commercial aeronautic interests bearing on international aerial navigation are problems affecting the interests of business men more than the interests of the governments.

What we need is an International Aeronautic Association representative of commercial aeronautic interests of all countries and which will perform in aeronautics the same functions that the C. I. N. A. is now attempting to perform, but from a new standpoint—from the standpoint of business and technical interests of all countries and without any reference to politics, the League of Nations or any international tribunal.

We have an International Chamber of Commerce. Why should we not have an International Aeronautic Association?

American foresight and business initiative were responsible for the creation of an International Chamber of Commerce in 1919. Will we *have* an International Aeronautic Association created through the initiative of American business men or shall we wait until the initiative in this matter is taken by some other nation as it has been the case so far in aeronautics?

We address these two questions to American business men interested in making America first in the air.

THE following resolutions were adopted at the Second Congress of the International Chamber of Commerce which took place in Rome last March:

"The Second Congress of the International Chamber of Commerce hereby recommends:"

1—"That the International Chamber of Commerce establish a permanent Advisory Committee which will include financial, industrial, legal and aviation experts.

2—That this permanent Committee examine the steps practicable, both immediately and subsequently to promote the international development of civil aviation for commercial purposes.

3—That the Committee maintain touch with any national or international organization so as to insure the closest collaboration, and that it exert every means at its disposal to increase the interest of financiers and business men in this respect with a view to arriving at an international regulation of aerial navigation."

The organization of this committee with the functions specified above were suggested in the June 5th, 1922, issue of the "Aerial Age" in the article on "Commercial Aviation Development in the United States", by William Knight, (see pages 294 and 311). The "Aerial Age" wishes to compliment Mr. Howard Coffin, President of the National Aeronautic Association of the U. S. A., upon the prominent part that he has had in having this resolution adopted by the Second Congress of the International Chamber of Commerce.

At the same time, however, that we unreservedly endorse the idea of creating an International Advisory Committee for Aeronautics as a permanent committee of the International Chamber of Commerce, we believe that aeronautic interests in the world are sufficiently broad, sufficiently important and sufficiently developed at the present time to lead to the creation of an International Aeronautic Association or of an International Chamber of Commerce specifically interested in aerial transportation. Aeronautics in our estimation has outgrown the stage of development when it mostly needed *advice* from either National or International Advisory Committees.

What aeronautics needs the most today is *action*. Action by business men who will avail themselves of the services of advisory committees whenever they need *advice*, in the meantime doing things in a business like way.

SINCE the war we have had at least a dozen International Aeronautic Expositions in Europe. Especially in Paris and London Aeronautic Expositions have been organized every year for the benefit of the export trade of French made aircraft and they have proved to be of the greatest benefit to the French Aircraft manufacturing industry.

On next August an International Aeronautic Exposition will take place in Sweden and no doubt it will be a great boom to the aeronautic industry of that country and it will open a new market where users of aircraft will go and in the future to buy aircraft. When are we going to have an International Aeronautic Exposition in this country where the airplane was born and which is leading the world in efficient operation of Commercial aviation?

Considering that we have been able to win all international records in aeronautics and are able to operate the U. S. Air Mail Service more efficiently and more economically than any other aerial operating concern in the world, we must have something to show and to sell in aeronautics to the rest of the world.

Who is going to discover America as a first class aircraft manufacturing nation? Who is going to organize an International Aeronautic Exposition in the United States? Who is going to prove that America is second to no other nation in the aircraft manufacturing industry?

We address this question to the National Aeronautic Association, to the Aeronautical Chamber of Commerce, to the Aircraft Manufacturers Association and to every individual and organization that wants to see America first in the air.

THIS month the Second Congress of Aerial Navigation will take place in London. At this Congress the matter of standardization of symbols, coefficients and methods of graphical representation used in aerodynamical publications and reports issued in every country, will be discussed. Recommendations to this effect were made at the first International Congress of Aerial Navigation which was held in Paris in November 1921, and some sort of action in this direction will develop at the London conference.

The matter of international cooperation in wind tunnel experimental work which is so vitally important to aircraft manufacturers of all nations will be discussed and a report will be made to the London Congress of the results obtained so far through a preliminary program of co-operative wind tunnel tests originated by the N. P. L. in England.

Germany as usual has not been invited to participate to the London Congress. Our own government will be represented as usual by representatives who will have no power to vote in any resolution adopted by the London Congress.

If the matter of International Standardization is going to be discussed and settled in London, what sort of international settlement will that be with the United States and Germany, (The only two countries in the world that have made any serious contribution to the development of aerodynamics), out of the way?

The National Aeronautic Association of U. S. A., is the only aeronautic body in the United States which is representative of National aeronautic interests, is not under the control of the U. S. Government and therefore is in a position to represent aeronautic interests of this country. This Association can take part in the discussion of international aeronautic problems and can vote on any resolution which will be adopted at the London Congress. This association can do for us what nobody could do at the First Congress of Aerial Navigation, when American aeronautics was conspicuously absent. We are confident that our National Aeronautic Association of U. S. A., will be properly represented in London.

Dr. Prandtl Joins Aerial Age Staff

DOCTOR of Philosophy and Doctor of Engineering Ludwig Prandtl, Professor at the University and Director of the Aerodynamics Experimental Station of Göttingen, Germany, has been appointed Associate Editor of AERIAL AGE.

Prof. Prandtl was born at Freising in Bavaria on February 4th, 1875. After attaining his B. A. degree, he studied engine construction at the Technical High School, Munich, from 1894-1898. He was then for one year with Prof. Föppl as his assistant in the laboratory for Mechanics and Testing Materials at the High School. Took his Doctor's degree at Munich University. From 1900-1901 was Engineer at the Augsburg Engine Works at Nürnberg. Although up to this time he had specialized in problems of Elasticity, he took up at this time the then unsolved questions of aero-dynamics and was commissioned to do some very important work in this new field of activity. In autumn 1901 he was appointed Professor of Applied Mechanics at the Technical High School of Hannover. From there he went, in the autumn of 1904, to the University of Göttingen. The research laboratory of this university which is now under his direction gave him the opportunity to test his theories on hydro-dynamics. He found there, too, a number of gifted students who participated in his researches, and aided him with mathematical and experimental contributions. In 1907, he successfully built a small aerodynamics laboratory, with funds contributed by the "Society for the Study of Aero-engines". This laboratory was afterwards taken over by the University. In the war years of 1915-17, he was enabled to build the large Aero dynamics Experimental Station, which still exists. The chief research work was done, however, in the smaller station in 1907.

Dr. Prandtl

(Concluded on page 282)

Howard E. Coffin, Pres. B. H. Mulvihill, V. Pres. B. F. Castle, Treas. John B. Coleman, Rec. Sec.

Official Bulletin of National Aeronautic Association of U. S. A.

Col. H. E. Hartney, General Manager Cable Address, Nalaero
National Headquarters, 26 Jackson Place, Washington, D.C.
The National Aeronautic Association of U.S.A. assumes responsibility for the statements under this heading

SINCE the last bulletin printed through the courtesy of the Editor, the chapter movement in the membership plans of the Association has made gratifying strides. The activities are listed by Districts.

FIRST DISTRICT

Requests for the formation of chapters from this District have reached national headquarters from the Mayor of Boston; William P. Sheffield of the Chamber of Commerce of Newport, R. I.; from the Chamber of Commerce of Providence, R. I.; while Frederick K. Harris, President of the Aero Culb of Vermont, states that the Aero Club will be changed to a chapter of the N. A. A. New Haven has also applied for a charter for a chapter in that city.

SECOND DISTRICT

Applications for chapters have been filed from Paterson, and Montclair, N. J.; Rochester, Albany, Gloversville, Binghamton, Newburg, and Watertown, N. Y.

THIRD DISTRICT

Applications have reached headquarters for the formation of chapters from the following cities:—Allentown and Pittsburgh, Pa.; and from Richmond, Danville, Roanoke, and Suffolk, Va., these cities and towns having undertaken the formation of chapters.

FOURTH DISTRICT

Chapters are being formed in Atlanta and Columbus, Ga.; Montgomery and Birmingham, Ala.; Tuscaloosa, Miss.; Pensacola and Tallahassee, Fla.; Macon, Ga.; Natchez and Pascagoula, Miss.; Statesville and Spartansburg, S. C.; and Chattanooga, Tenn.

FIFTH DISTRICT

Chapter activities are under way in Indianapolis, Vincennes, and Fort Wayne, Ind.; Louisville, Ky.; Akron, Lorain, and Painesville, Ohio; also in Xenia and Dayton, Ohio; and in Wheeling, West Va.

SIXTH DISTRICT

Chapter organization is now going on in Monmouth, Ill.; Battle Creek, Detroit, and Wekkston, Mich.; and in Milwaukee, and West Bend, Wis.

SEVENTH DISTRICT

A chapter has been formed in Davenport, Iowa and others are being formed in Duluth, Minneapolis and St. Paul, Minn.: St. Louis and Kansas City, Mo.; Waterloo, Des Moines and Cedar Rapids, Iowa; and Omaha, Neb.

EIGHTH DISTRICT

Chapter activities are going on in Prescott and Phoenix, Ariz.; Ft. Collins, Colo.; Elreno, Okla.; Dallas, San Juan and San Antonio, Texas; the chapter at San Antonio will be one of the largest in the south, over 300 members having already joined this chapter.

NINTH DISTRICT

Chapter formation is going on in Anaheim, Glendale, Pasadena, Sacramento, San Diego, San Francisco, and Los Angeles, California; Helena and Wolf Point, Montana; Eugene, Ore.; Sheridan, Wyo.; and Seattle, Washington.

These additions to previous lists show chapter activities in 147 cities and towns from the Atlantic to the Pacific coasts and from the Canadian border to the Gulf of Mexico.

———

Three Hundred Thousand Shriners from all over the United States will attend the Shrine Conclave in Washington the first week in June. Through the activities of the Association, the following organizations will stage what will probably be the largest aeronautical show ever held in the United States: Army Air Service; Bureau of Aeonautics of the Navy; Post Office Department; Weather Bureau; Bureau of Standards; and the Smithsonian Institution.

On Monday, June 4th, the Post Office Department and the Weather Bureau will hold exhibitions from 10 a. m. to 2 p. m. On Tuesday, June 5th, from 10 to 2 the Navy will conduct educational exhibitions of aeronautical activities in naval aviation. It is expected that the aircraft carrier, Langley, will be in the Potomac and that bombing and torpedo dropping, smoke screen and other purely naval aviation maneuvers will be carried out, and, in addition, the Marine Corps flyers will take photographs from the air, develop them in the air and drop the prints down to the crowd below.

On Wednesday, the 6th, the Army Air Service will carry out all kinds of aerial maneuvers incident to the wartime use of aviation and in connection, General H. H. Bandholtz will stage with the military forces, ground operations on the Monument Lot in coöperation with the Air Service.

Thursday will be aviation day at the Bureau of Standards and Friday, aviation day at the Weather Bureau, and, throughout the entire week, the Smithsonian Institute with its remarkable aviation exhibition, the Weather Bureau and the Bureau of Standards will be open to visitors. Consequently, the entire week will present a program along educational lines so that the business men represented by the Shriners will have first hand opportunity of inspecting the governmental air services and their activities and, it is believed, that the concrete evidence of aeronautics as a factor in the industrial life of the nation and as a vital adjunct to the national defense, will be better known.

By: C. A. Tinker,
Director of Information,
National Aeronautic Association.

(*Concluded from page 266*)

the light cord on the further arc is slowly wound on to it while the cord on the nearer arc unwinds. The lower ends of these cords are fastened to a lever system which transmits the average rotation of the arcs to a fine wire passing around a small shaft carrying the pointer of the graduated dial seen in the left foreground. The distortion thus registered in inches may be converted to degrees of arc by the use of a suitable factor. The downward motion of the specimen is eliminated from the dial readings by causing the dial and lever system to move downward at the same rate. This is effected by supporting the dial on the pantograph arrangement fastened to the crosshead and adjusted to reduce the crosshead motion by one-half.

The large weights seen on either side serve merely to counterbalance the weight of the disks on the sides not pendant from the frame. Coil springs inserted in the light chains just above these weights relieve the jar accompanying sudden failure of the specimen, and protect the chains against breakage.

(*Concluded from page 281*)

Prof. Prandtl's collaborators in the field of aero and hydro-dynamics should also be mentioned: First phase —Prof. V. Karman and Dr. Blasius; Second phase—Dr. Fuhrman (fallen in war); Dr. Föppl; Dr. Betz; and Dr. Wieselsberger. To these last two names are to be added those of Dr. Munk, now with the National Advisory Committee for Aeronautics, and Engineer Ackeret.

It should not remain unmentioned that the principal development of the Aero-dynamic Institution at Göttingen is due to the devotion of the celebrated mathematician, Felix Klein, whose life task has been the promotion of the applied Sciences, and their relation to pure Science.

Prof. Prandtl is one of the most distinguished scientists that honor Germany today and his contribution to the development of aerodynamics makes him a world leader in the scientific field of aeronautics.

AERIAL AGE considers it a great privilege to have Prof. Prandtl on its Editorial Staff and we are glad to welcome him as one of our family.

THE NEWS of THE MONTH

The McLeish Memorial Aeronautical Library

Acceptance on behalf of the National Aeronautic Association of U. S. A., of a gift of a complete collection of books on aeronautics and kindred sciences, has been announced by B. H. Mulvihill, vice president. The gift collection has been named at the request of the donor, "The McLeish Memorial Library," in honor of Lieutenant Kenneth McLeish, U. S. N., Naval aviator, who died in combat during the World War.

The donor is Lieut. Clifford A. Tinker, a member of the Association attached to the staff at National Headquarters, who stated in offering his large collection of volumes on aeronautics that he hoped thereby to establish the nucleus of a research library available to all persons interested in the science and engaged in activities furthering the progress of aeronautics in the United States. Lieut. Tinker has also furnished a handsomely engraved book-plate for the library, which, it is hoped will receive from authors and publishers additions of books so as to keep the collection abreast with modern thought, invention, and practice in aeronautics.

"The gift", says Lieut. Tinker, "is a slight token of my appreciation of the Association and of my comrade Kenneth McLeish". McLeish, who was born in Glencoe, Ill., was an ensign in the Naval Reserve Force when the United States entered the World War. He went to France in October, 1917, and in December was sent to the aviation acrobatic school at Gosport, England, for instruction. He was later instructed in aerial gunnery at the Royal Flying Corps School in Turnberry, Scotland, and in squadron formation flying at the school at Ayr, Scotland. In March, 1918, he was assigned to the U.S. Naval Air Station at Dunkerque, and promoted to the rank of lieutenant. He then took a course in day bombing in France while on duty with the Northern Bombing Group, to which he was assigned on October 4, 1918. He was operating with a British squadron of bombers over Leffingem, Belgium, on October 15, when attacked by an enemy combat group. McLeish, who was flying a faster airplane than the British bombers, engaged the enemy while the slower ships escaped. He shot down several of the attacking planes and was himself sent to earth after one of the most gallant exhibitions of courage, fortitude and fighting ability exhibited by an American aviator throughout the war. When hostilities ceased his body was found at Schmore, Belgium.

Lieut. Tinker was acting chief engineer of naval aviation in Europe during the World War; aide to Secretary Daniels in the trans-oceanic flight of the NC-4 seaplane which flew across to Portugal, and was on duty with the ZR-2 rigid airship detachment in England, press of business in London detaining him from making the last disastrous flight of that unfortunate craft. As aide to Rear Admiral W. A. Moffett, chief of the Navy's Bureau of Aeronautics, he was engaged in writing the history of naval aviation, and his authoritative articles on aeronautics have appeared in the leading magazines here and abroad.

In accepting the gift from Lieut. Tinker, Vice President Mulvihill wrote: "I am at a loss for words to express my deep appreciation of your gift and in accepting it, I can only say that this gift is comparable to your great interest in and efforts toward helping the Association achieve its principal aim of placing 'America First in the Air.'"

The library will be installed at National Headquarters, 26 Jackson Place, Washington, D. C., and the National Aeronautic Association is having prepared a memorial volume relative to the foundation to be presented to the parents of Lieut. McLeish.

Dept. of Agriculture Uses M. B. Balloon

The M. B., a new motor-balloon craft designed for the Army, capable of hovering over a specified area, has been turned over to the Department of Agriculture to fight the gypsy moth which is destroying the forests of northern New England. The ship has been tested at the Army Air Service engineering division at Dayton, O., and will fly to Concord, N. H. starting June 1, by way of Hammondsport, N. Y., where the craft was constructed by Airships, Inc.

This motor balloon, according to the builders, is a new development, on finer lines than the service "blimp", equipped with two motors of 75 horsepower each and capable of carrying five passengers. An Army crew will navigate the ship, which will be based at Concord for the extensive operations over the rapidly disappearing forests. The craft is supplied with a new type of mobile field equipment, and when on the ground will be held to a folding mooring mast anchored on a motor truck. Trucks will also carry a gas compressor plant to supply the hydrogen, so that the outfit will be self-contained wherever it may be operating.

Beckwith Havens, vice president of Airships, Inc., builders of the M. B., stated that this ship was the first to be constructed in the United States specifically for the purpose of spraying and powdering with chemicals forests infected by parasites, and the first craft of its size to utilize two motors. At the headquarters of the National Aeronautic Association he urged that this field of "salvage" by using aircraft be cultivated through an educational movement to present to the states battling against plant-destroying pests the economic utility of airships as well as airplanes.

New York State, he said, has appropriated $150,000 to fight the gypsy moth along the border from the St. Lawrence river to Long Island Sound, but this effort from the ground is destined to prove inadequate, according to Mr. Havens. With aircraft, Mr. Havens said, a great area can be sprayed in a few hours, and repeated spraying overtake the new breed of moths as they appear. The work in New Hampshire is in conjunction with the Federal government and will be conducted on an approved plan of campaign.

N. A. A. To Press New Rule for Flights in U. S.

The dissatisfaction expressed by Lieuts. Macready and Kelly because the existing rules of the Federation Aeronautique Internationale do not allow a world record for their non-stop flight from New York to San

Diego, and the indignation felt that the United States is penalized because long distance straight-away flying is possible without crossing a border line, will probably result in amendment of the rules. This opinion was expressed today by officials of the National Aeronautic Association of U.S.A.

"Our petition to strike out the requirement in distance flight of the restriction forcing avaitors 'to return to the point of departure,' was filed at the March meeting of the F.A.I. in Paris," said B. H. Mulvihill, vice president of the association. "The Contest Committee, thru its chairman Col. F .P. Lahm, of the Army General Staff, therefore anticipated by several months a performance which would show the injustice of this restricting rule. The wonderful cross-continent flight of Macready and Kelly did this convincingly.

"The F.A.I. is charged with the international regulation of aeronautics for the purpose of making comparable the results of all trials, races, etc., also with actual supervision of aeronautical activities. As the American representative of the F.A.I.," Mr. Mulvihill pointed out, "the National Aeronautic Association, as it declared in the statement issued on May 3, cannot do otherwise than obey the statutes of the international federation. Our Association by its petition filed for consideration at the March meeting in Paris has taken the only course left open to us to secure amendment of this obnoxious rule. The amendment to become effective must be adopted by a two-third vote, and we are confident that the strong argument presented by our Contest Committee will appeal to the sportsmanship of the bodies co-operating in the F.A.I., which is primarily a federation controlling aeronautic sport in 23 countries, including the United States."

The plans for national recognition of the achievements of Macready and Kelly and all the fliers who shared in breaking eleven world records at a public ceremonial in Washington are taking shape, said Mr. Mulvihill. The idea has met nation-wide endorsement and interesting details of the ceremony will shortly be announced from Washington headquarters of the N.A.A., it was stated.

Will Offer $235,000 as Helicopter Prize

The Air Ministry in the near future will announce the offer of a prize of £50,000 (about $235,000) for a successful helicopter device enabling airplanes to rise vertically from the ground, descend in a like manner and to hover stationary in the air.

The winning machine must attain an altitude of 2,000 feet, carry a pilot and enough gasoline for an hour, fly at least sixty miles an hour and remain stationary in a twenty-mile wind for half an hour.

Army Board Finds Air Defense Vital

The value of aircraft for coast defense purposes when used with coast artillery weapons was demonstrated in joint exercises recently held at Fort Monroe by the Coast Artillery and Air Service forces of the regular army.

The special board which observed them has just submitted to the Secretary of War a report in which, among other things, it asserts that artillery fire can be satisfactorily conducted by the use of airplane data alone, when visibility from shore stations is interfered with by any cause, provided two-way radio communication is assured.

During the exercises airplanes were used for "spotting" the range and position of targets, for dropping bombs on targets, and in the projection of smoke screens. For military reasons the exact nature of the problems undertaken is not disclosed, beyond the statement that the board observed the results of a series of ten typical major operations, each of which constituted a problem in the combined use of coast artillery and air service elements. The results, however, were most gratifying.

Salient feautres in the conclusions of the board relative to these problems are:

"First—That the air service can locate and report the approximate position, direction and speed of hostile ships and inform shore stations of appreciable changes in such data, provided two-way uninterrupted radio communication is obtained and visibility is at least fair.

"Second—That this information is not only valuable for giving warning of the apparent intentions of hostile fleets, but also for placing initial shots by coast artillerists, and for the correction of firing data so as to bring successive shots effectively near the target.

"Third—That the radio direction-finders have not been developed sufficiently yet to be effective, but the result of their use justifies extensive investigation and development in the future.

"Fourth—That the present development of radio permits the use of about six planes, working simultaneously with as many ground stations, in a single locality, but if greater numbers are used the interference of wave lengths become excessive."

Secretary Weeks has approved the report and has directed Major Gen. Frank W. Coe, Chief of Coast Artillery, and Major Gen. Mason M. Patrick, Chief of the Air Service, to draft a tentative instruction manual for guidance in combined coast artillery and air service exercises.

"Both coast artillery and air service," the board declares, are essential to successful operation of coast defense. The exercises were not sufficiently comprehensive to determine the relative efficiency of seacoast gun attack and aircraft attack upon naval ships within gun range. Both have exceedingly great value and should be used in co-operation. Hostile ships can probably jam our radio communication, but by so doing they would also seriously interfere with their own vital radio communications. Our planes could then probably act at shorter range with effectiveness."

Some of the board's detailed conclusions are disagreed with by General Patrick, Chief of the Air Service, who feels that the exercises were not sufficiently comprehensive to give definite conclusions.

Fear Aircraft Shortage

A special board, composed of General Staff officers, has been convened by the War Department to investigate and report to Secretary Weeks on the aeronautical industry in the United States. Army officers, charged with organizing key industries as a part of the peace time industrial mobilization, have learned that many air craft plants developed during the war have practically ceased to exist and that there are only about twenty now operating. These, in the opinion of some Air Service officials, are inadequate to the military needs of the country in case of emergency.

Information laid before the War Department says in part:

"The aeronautical industry in the United States today is at a very low ebb, with little prospect of improvement in the near future. Unless something is done to remedy this situation it will become worse in the next year or two."

This opinion is known to be supported by Major Gen. Patrick, chief of the Army Air Service, who left Washington recently to visit various Air Service stations and industrial centres. He recently reported that commercial aviation had not developed to the point where it offered sufficient encouragement to aircraft manufacturers, and military peace time demands did not permit the army and navy to place orders in sufficient quantity to keep the industry at work.

American Balloon Races July 4

Fourteen balloons will start in the national elimination race from Indianapolis, Ind., on July 4, according to announcement of the contest committee of the National Aeronautic Association, which approved the date for the annual balloon meet. Three of the entries promise some sensational departures from the usual balloon design, it is reported from Indianapolis, whose Aero Club and Chamber of Commerce jointly are promoting the contest. A purse of $3,000 will be divided $1,000 first, $800 to second, $600 to third, and $300, $200 and $100 to fourth, fifth and sixth, respectively.

The contest is for distance navigated and the three leaders automatically become the entrants from the United States in the international balloon race to be held in Belgium next September. The Army and Navy air services will each enter two balloons at Indianapolis. The official starters, timers and observers will be appointed by the National Aeronautic Association, which is the sole representative in America of the world aeronautic federation, known as the F.A.I.

American Airmen Credited with 11 Records in 20 days

Eleven records, six of them exceeding accepted world marks, have been officially credited to American aviators by the contest committee of the National Aeronautic Association, Chairman F. P. Lahm. These records were all made in a period of 20 days from March 29 to April 17 at Dayton, Ohio, by Army aviators. Five of these records for speed over distances from 2,000 to 4,000 kilometers are entirely new performances in the history of aviation.

The United States is now credited with fourteen airplane records which have been accepted by the National Aeronautic Association and authenticated to the federation of aeronautic bodies.

The altitude world mark of 34,509.5 feet made by Lieut. John A. Macready has stood since Sept. 28, 1921. The 100 kilometer speed record and the 200 kilometer speed record, made by Lieut. R. L. Maughan, have not been exceeded since flown Oct. 14, 1922. In these performances Maughan made speeds of 205.31 and 205.94 miles per hour, respectively. The official figures for the eleven new records are as follows:

Airplane Speed Records

Maximum over one kilometer: 236.587 miles per hour, by Lieut. R. L. Maughan, U.S.A., (March 29) exceeding record of Sadi Lecointe, France, of 233.01 miles per hour.

500 kilometers: 167.807 miles per hour, by Lieut. Alexander Pearson, U. S.A., (March 29) exceeding record of Lieut. Batelier, France, of 114.45 miles per hour.

1000 kilometers: 127.43 miles per hour by Lieuts. H. R. Harris and Ralph Lockwood, U.S.A. (March 29) exceeding record of Lieut. Carier, France, of 75.81 miles per hour.

1500 kilometers: 114.33 miles per hour, by Lieut. H. R. Harris, U.S.A. (April 17) exceeding record of Boussoutrot and Bernard, France, of 58 miles per hour.

2000 kilometers: 114.22 miles per hour, by Lieut. H. R. Harris, U.S.A. (April 17).

2500 kilometers: 71.83 miles per hour, by Lieuts. John A. Macready and Oakley C. Kelly, U.S.A. (April 16-17).

3000 kilometers: 71.62 miles per hour, by Lieuts. John A. Macready and Oakley C. Kelly, U.S.A. (April 16-17).

3500 kilometers: 71.34 miles per hour, by Lieuts. John A. Macready and Oakley C. Kelly, U.S.A. (April 16-17).

4000 kilometers: 70.77 miles per hour, by Lieuts. John A. Macready and Oakley C. Kelly, U.S.A. (April 16-17).

Airplane Duration Record

By Lieuts. John A. Macready and Oakley C. Kelly, U.S.A. (April 16-17) 36 hours, 4 minutes, 0.31 seconds; exceeding record of Bossoutrot and Drouhin, France, of 34 hours, 19 minutes, 7 seconds.

Airplane Distance Record

By Lieuts. John A. Macready and Oakley C. Kelly, U.S.A. (April 16-17) 2516.55 miles; exceeding record of Boussoutrot and Bernard, France, of 1190.04 miles.

The maximum speed record over the one kilometer course was first accredited to Lieut. L. J. Maitland, at 239.95 miles per hour, but this mark was not accepted because of a technical violation of the rules, Maitland's plane on two trips over the course failing to maintain horizontal flight. Under the official rules the flight of Lieut. R. L. Maughan of 236.587 miles per hour established a new world record, exceeding the mark of Sadi Lecointe of France of 233.01 miles per hour by more than three miles. The record has been authenticated as Maughan's, although the officials declare that Maitland's technical violation was undoubtedly unintentional on his part and that probably no speed was gained by the gradual descent of his airplane while speeding across the short course. The Contest Committee of the N.A.A. in a letter to Maitland says: "You have shown yourself to be one of the greatest high speed pilots in the world, and regardless of our inability to homologate your flight, it will always be felt that you have traveled faster than any human being on earth:"

Eleven Countries Agree on National Plan to Promote Civil Air Transport

In their opinions of commercial conditions in Europe brought home from the International Commercial Congress at Rome by members of the large American delegation there is no deeper note of optimism than that relating to aeronautical progress. From reports of the delegates who represented the National Aeronautic Association of U.S.A., headed by Howard E. Coffin, of Detroit, president of the association, the precipitation by the Americans of the sentiment of the air group into an agreement upon a formula of principles for the promotion of civil air transportation was one of the outstanding accomplishments of the congress. This group considered the question from a purely business point of view and its conclusions were incorporated in a resolution adopted by the congress declaring the extreme importance of air transport made necessary the development of the commerical side of aviation as a powerful factor in the betterment of commercial relations throughout the world.

The resolution was the result of a thorough study of replies from eleven nations to a questionnaire on the problems of air transport made by a sub-committee whose members represented France, Great Britain, Italy and the United States. In its adoption the congress subscribed to the recommendation that "any national funds spent on aviation should be in part devoted to developing civil aviation and thereby create a permanent and eventually self-supporting form of transportation and which would at the same time be available for national defense."

Further, the congress accepted and endorsed the establishment of "a permanent international advisory committee, which will include finan-

(Concluded on page 298)

Elias Night Bombardment Plane

G. Elias & Bro. Inc., of Buffalo, N. Y. were one of three successful competitors submitting to the Army Air Service designs for Type 12, Multi-seater, short distance night bombardment experimental airplane. This is the sixth award received by the Elias company in Army and Navy design competitions.

Aircraft Standardization

Several conferences have been held during the past month by the Aircraft Standardization Committee, representing the Society of Automotive Engineers, Aeronautical Chamber of Commerce and Manufacturers Aircraft Association. The preliminary drafts of a proposed code as circularized by the joint sponsors, are being examined in detail for sympathetic criticism and discussion in the near future.

Gothenburg Aero Exhibition

The following European companies have announced that they will participate in the International Aero Exhibition:

Great Britain: Vickers, Ltd. (flying machines). Bristol Aeroplane Co. Ltd., and Armstrong Whitworth Aircraft, Ltd. (both flying machines and motors) and Rolls-Royce, Ltd. (motors).

France: Sous-Secretariat d'Etat de l'Aeronautique (statistics, etc.) Aeroplanes "Caudron" (flying machines), Henry Potez (flying machines), Societe Nieuport Astra (flying machines and models), Societe Louis Breguet (flying machines and models), Pierre Levasseur (propellers), Establishments Liore et Oliver (flying machine), Societe Radio-Electrique (radio materials), Aera (Instruments), Paulin Ratier (propellers), Hanriot (flying machines) and La Hispano-Suiza motors).

Italy: Gianni Caproni (flying machine), Macchi (flying machine), Savoia (flying machine) and Gabardini (flying machine).

Czecho-Slovakia: Usines militaires (flying machines).

Germany: Junkers Flugzeugwerk A. B. (flying machines motors models). Dornier-Metallbauten G.m.b.h. (flying machines), Albert Wigand (instruments), Albatross G.m.b.h. (flying machine), Udet (flying mach.) Baumann & Lederer (flying materials), Bahnbedarf (flying materials), Baumer Aero (flying machine), Stahlwerk Mark (flying machines and motors), Steffen & Heyman (motors and flying materials), and Telefunken (radio materials).

Sweden: Swedish Army and Navy (flying machines, materials) Swedish Aero A.B. (flying machines) A.B.A. Wiklunds Maskin & Velocipedfabrik (motors), Gas Accumulator (wind direction indicator and possibly, air lighthouse), Transit Kompaniet (flying materials), Swedish Wireless Telegraphy A.B. (radio materials). Other reported exhibitors are: Accumulator A.B. Jungner, See Fabriks A.B., Swedish Ball Bearing Co., A.B., Mack Meters, Fagersta Bruks A.B., George Hjort & Co., Sandvike Iron Works and others.

There are 34 types of flying machines and 16 types of flying machine motors announced to be represented at the Exhibition. It is expected that there will be not less than 50 different types represented.

Air Mail Records Furnish Important Wind Data

Allowance must be made for a wind of about 7 miles an hour from the West, at the average altitude of air mail flight, it has been found from an analysis of one year's records of the Air Mail Service between New York and San Francisco. A discussion of the wind factor in flight as it affects commercial aviation was presented at the recent semi-annual meeting of the American Meteorological Society by W. R. Gregg of the Weather Bureau of the U. S. Department of Agriculture. Lieut. J. P. Van Zandt of the U. S. Air Service collaborated in analyzing the records.

A more detailed study of the New York to Chicago part of the route gives almost exactly the same wind factor as for the entire trans-continental route. This value of the wind factor has been verified by an examination of 8,700 upper air observations with kites and balloons, and the agreement is remarkably close. The importance of this agreement lies in the fact that, in fixing flight schedules in other regions or at other altitudes, dependence can be placed upon either method in case only one is available.

Schedules that can be guaranteed 90 per cent of the time have been determined for aircraft of any cruising speed between 50 and 150 miles per hour. In making up these schedules allowance has been made for head winds of 36 miles per hour or more in westward flight, and 20 miles per hour or more in eastward flight, as these winds have been shown by kite and balloon records to occur 5 per cent of the time. When they do occur flights will be somewhat delayed, but nevertheless completed. During the remaining 5 per cent of the time flights are likely to fail altogether or be seriously delayed because of exceptionally unfavorable weather, such as severe rain or snow storms, poor visibility and other difficulties.

Reed Metal Propeller

The following corrections should be noted in the article by Dr. Reed published in the April issue.

page 182, middle col., 4th line read "tip speeds seldom exceed 900 feet per. ."

page 183, middle column, 12th line, read "ratio of thrust to tip speed undergoes no appreciable variation. ."

page 183, 3d col., 18th line, read "50 per second. ."

page 185, 1st col., 13th line, read "682 ft. p.s. only," instead of 250 as printed

page 182, 3d col., 3d par. The asterisk should refer to "Berthall 'Guns and Gunnery'" and not to a paragraph of the article proper.

In the report of experiments on aerofoils at high wind tunnel speeds by the National Advisory Committee for Aeronautics published in 1920 the highest wind speed was 682 ft. per sec., whereas the air reactions described by Dr. Reed in his article do not begin to be important until a speed of nearly 1000 ft. per sec. is reached.

Tests were made in 1919 and 1920 at McCook Field of a metal propeller reaching a tip speed of over 1300 ft. per ft. per sec. but the propeller was fluttering violently and the highest tip speed reached without flutter was 837 ft. per sec. Therefore, the data for higher tip speeds are valueless for the purpose in hand.

ARMY and NAVY AERONAUTICS

New Navy Pay Schedule

The new schedule of pay for civil employes in the Naval Establishment is announced, to take effect May 1.

In the Drafting Service, the rates of pay range from $4.16 for a plain copyist per day of seven hours to as high as $14.96 for chief draftsmen.

In the Technical Service, aeronautical aids receive $8.32 and $13.28, while aeronautical aid (photographic) is paid $13.28. An aeronautical engineer receives, $6.88, $7.20, $7.60, $7.84, $8.72, $9.44, $10.56, $10.96 while an assistant aeronautical engineer receives $6.08, $7.20 and $7.44. Oh, to be an aeronautical engineer! An assistant airplane inspector's pay ranges from $5.36 to $9.44.

Under the heading of Laborer, Helper and Mechanical Service, the maximum rate per hour is 73 cents for general or motor aircraft mechanic. "Motor" mechanic. The Navy has its own nomenclature. The N. A. C. A. dictionary means nothing to the Navy, if one judges from Mr. Roosevelt's pay tables.

All these salaries or pay do not consider the risk in flying, for all employes detailed to flying in connection with testing apparatus or appliances on aircraft or testing out aircraft are allowed 50 per cent additional to their regular rate of pay for the day they fly, but they shall fly only on approval of the commandant or other officer in charge. No employes shall fly without such authority, secured in advance for each flight.

Portable Mooring Mast for Airships

A portable rigid airship mooring mast which may be used extensively in advance base operations by naval airships and which would also have great value in connection with the commercial operation of airships is being developed by the Navy Department.

Preliminary design of the portable mast has been completed and if further development proceeds as favorably as at present, it is probable that several will be constructed for use in connection with the extended flights of the ZR-1.

The mast as designed is about 115 feet high as compared with 165 feet for the permanent mast at the Naval Air Station, Lakehurst. The portable mast, however, is intended to be set up with a minimum of labor and possibly to remain set up for a comparatively short space of time. Consequently the lower height of the mast would be an advantage, although it requires a little more careful handling of the ship while at the mast. The plans provide for an extremely simple structure. It is intended that as great a use as possible shall be made of the facilities afforded by the locality in which the mast may be set up and no extensive foundation or anchorage of concrete will be required.

The value of the portable mast to airship operations far removed from a permanent base is obvious. In this respect it lays claim to consideration not only from the military viewpoint, but as a means to facilitate exploration and commercial air lines.

Marines Fly Four Martin Bombers from Coast to Coast

Completing their transcontinental flight two days ahead of schedule, the four Martin bombers under the command of Major R. S. Geiger, USMC, arrived in Washington on Monday, April 30th, and were met by a distinguished party of government officials headed by the Secretary of the Navy. The four bombers left San Diego on April 19th for the overland flight and proceeding by easy stages across Texas and thence north to Kansas City made the flight without incident. It is estimated that $20,000 in transportation charges were saved to the Government by flying the planes overland. They would have necessitated a train of twenty cars if crated and shipped by rail. The pilots were greeted at the Naval Air Station, Anacostia, D.C. by Secretary Denby, Rear Admiral Moffett, Major General LeJeune, Major General Neville, Lt. Colonel Turner, Mrs. Denby and Mrs. Moffett, who congratulated them on their successful trip.

The Last of the P. T.'s.

Orders were issued by the Bureau of Aeronautics authorizing the turning in of all P.T. torpedo planes to the Naval Aircraft Factory upon the return of the Torpedo Plane Squadron to Hampton Roads from the winter base in Key West. The P.T. will be replaced within the coming month by the new DT torpedo plane which has shown such remarkable performance qualities in recent tests. The passing of the P.T.'s will cause little regret among the squadron pilots who have been looking forward with eagerness to the arrival of the new ships. However, the P.T. has been a valuable development type, and much has been accomplished with it in torpedo plane work that has paved the way to a wider field of usefulness for the advanced design.

Submarine Plane Has Further Trials

The submarine plane which has been under construction at the Martin plant in Cleveland for the Navy has had additional test flights by the test pilot of the Martin Company and by Lieutenants Pond and Strong of the Navy. It is expected that the tiny plane, the smallest seaplane in the world, will soon be brought to Anacostia for extensive trials. The MS has a span of 18 feet and the fuselage is 17-½ feet long. The power plant consists of a three cylinder 60 H.P. Lawrence engine. Fully loaded, the weight is 1,000 lbs. Assembled and ready for flight, it could be placed in an average size living room with plenty of space to spare.

ZR-1 Power Plant Under Test

The ZR-1 power plant complete is being given a test run at the Aircraft Factory mounted in one of the power cars. It is planned to complete and test the power cars at the Aircraft Factory and ship them to Lakehurst to be applied to the hull. The hull structure of the ZR-1 is practically complete and application of the outer cover has commenced.

New Landing Field for Aircraft Factory

Admiral Moffett recently went to Philadelphia by air to inspect the work on the new landing field that is being constructed adjacent to the Naval Aircraft Factory. Work has been started on the reclamation of 80 acres of ground to be made by dredging operations in the approaches to the League Island Navy Yard.

When completed the field will be the finest in the eastern section of the country. It will be approximately 800 yards long and 400 yards wide with excellent approaches from all directions.

U. S. S. Langley

Reports received from the Langley indicate that landings and take-offs from the flying deck are made so frequently that it is becoming a routine matter. Aeromarine 39-B and Vought planes are used for such exercises. Extensive operations were carried on while the ship was at Panama to demonstrate for Army, Navy and civilian officials.

550 H. P. Model T Wright Engine Tested

Preliminary flight tests of a DT-4 plane equipped with a 550 H.P. Model T Wright engine were carried out recently at the Aircraft Factory in Philadelphia. The DT-4 differs from the DT-2 only in respect to the lower plant equipment.

Liberty Develops 470 H. P.

Preliminary bench runs of the Navy Aeromarine reconstructed Liberty engine at the Naval Aircraft Factory developed 470 H.P. at 1800 revolutions. A contract for forty of these engines has been let.

World's Record for Weight-Altitude

A new world's record was established by Lieutenant Rutledge Irvine, USN, at McCook Field, Dayton, O., when he ascended to a height of 11,300 feet with a load of 2405 pounds, and an observer in a Douglas torpedo plane. Irvine was in the air for two and one half hours. According to accounts of the test, it would have been possible to climb to 19,000 feet if the plane had been equipped with a super-charger. The altitude weight carrying record, lacking somewhat the spectacular features of other records in aviation, is of great importance, and of marked interest in connection with the development of the torpedo planes for service requirements. Those who have had experience with the P. T.'s which are now in use in the Fleet will appreciate the advantages of a torpedo plane with superior qualities of maneuverability and ceiling under full load conditions. The D. T. used by Lieutenant Irvine was equipped with a reconstructed Liberty engine which had been modified at the Washington Navy Yard.

18 Foot Propeller for ZR-1 Passes Test

The geared drive propeller which will be used on four of the Packard engines for the ZR-1 has successfully passed tests on the whirling stand at McCook Field. The power plant installation of the ZR-1 will be equipped with four geared drive and two direct drive propellers. The former are designed to absorb 300 H.P. The propeller which has been under test is 18 feet in diameter and is constructed of wood.

Smoke Screens Laid by Naval Aircraft

The possibility of laying smoke screens from aircraft has recently been under investigation at the Naval Air Station, Anacostia, D. C., and some very interesting results were obtained from experiments which point to the practicability of naval planes performing efficient duty in this manner. The smoke screen is created by chemical reaction and is projected from the exhaust line of the engine. One of the tests over the Anacostia River blanketed the Army War College in a heavy cloud of smoke. As a whole the experiments point the way to interesting and valuable developments in this line.

Speakin' of the record Some Reporters are Dumb

Maj. ——: Pretty good flight Macready made, wasn't it?

Reporter: Sure, indeed it was. Too bad it couldn't have been made by an American machine.

Maj. ——:What's the machine got to do with it—it was the engine. What do you want to do it with—a Jenny?

Reporter: Admittedly, the plane wouldn't fly without the engine. But it was the plane that carried the gas.

Maj.——: It was the engine that did it.

Reporter: Well the Navy developed the Liberty, didn't it?

Maj. ——: For an aeronautical expert, that's dumb.

Army Has Largest Non-Rigid Airship

The largest non-rigid airship in the world has just been completed at the plant of Airships Incorporated, at Hammondsport, N. Y., and delivered to the United States Army Air Service. The new ship, which possesses many novel devices, is known as the RN-1. It will be stationed at Scott Field, Belleville, Ill., the location of the second largest airship shed in the country, the largest being the double shed at the Naval Air Station, Lakehurst, N. J.

The Army RN-1 is 262 feet in length and more than 48 feet in diameter. It has a gas capacity for hydrogen or helium of 325.000 cubic feet of hydrogen or helium, can lift 21,000 pounds and maintain an altitude of 10,000 feet. It is primarily a fighting ship; and is equipped with bombs and machine guns. From the cabin which is 55 feet in length a gun tunnel extends upward through the hull to a fighting platform on top. This platform accommodates a machine gunner and two observers. A crew of twelve officers and enlisted men will operate the RN-1 and their training with the big non-rigid will begin at Scott Field within the next few days.

The RN-1 is powered with two 400 horsepower Liberty engines, which give it a speed of 60 miles an hour. The envelope of the airship is made of special 3-ply rubberized balloon fabric with an outer coating of aluminum—in all 6,000 yards of fabric were used, together with 300 gallons of special rubber cement, 60,000 feet of tape and 5,000 feet of steel cable.

The Verville-Sperry Performs

The Verville-Sperry Racer, which participated in the Pulitzer Race last October, and is now at McCook Field, was taken up recently for the purpose of obtaining moving pictures of the airplane in flight with the retractible chassis drawn in. The value of the retractible chassis arrangement is proven by the fact that official timing records of the airplane show that an increase in speed of 28.3 miles per hour is gained with the landing gear retracted during flight. The maximum speed of the airplane is 191.1 miles per hour in the retracted position and 162.8 miles per hour with the chassis in the normal position.

EQUIPMENT DEVELOPMENT at McCOOK FIELD

NOT only has McCook Field been assiduous in the development of new and improved pursuit planes like the Fokker, observation, bombardment and attack craft, new armament, the Bothezat captive airplane, aircraft cannon and many other items, but the equipment of the airplane has been given close attention.

Electrical Equipment

The engine-driven generators of 25 and 50 amperes are now being developed as part of a central electric power plant for heating, lighting, radiotelephone and telegraph, etc. A satisfactory night landing lamp has been worked out and electrically illuminated instrument boards. Signal lights for code and inter-plane signalling by night have been worked out. Other devices for night flying, such as non-glow exhaust manifold, tracer ammunition, illuminated gun sights and parachute flares are being developed.

Two models of electric engine starters are now in use for "aviation" engines. Doubtless these can also be fitted to airship engines as well. A new and lighter suit of electrically heated fabric is being brought out. Development work continues on an electrical tachometer.

Instruments

Attempts are being made to get around the limitations of the magnetic compass by developing a gyroscopic compass or an earth inductor located in the tail of the machine. New projects in the instrument field include: field calibration outfit, new instrument manuals, air-speed meters for airships, air pulsation tachometer transmission, radium pen for use in barographs as a substitute for ink, which freezes; optical recording manometer for measuring pressures on control surfaces of airplanes under test, in which the National Advisory Committee for Aeronautics will be especially interested; the development of sensitive syphons, speed measuring station which will use the theodolite system for measuring speed, rate of climb and altitude of any airplane.

The chronometric tachometer has been modified to fit into a case in such a manner that the scale is straight and vertical instead of being around the circumference of a circle. A special fuel pressure gauge and engine altitude gauge have been developed for super-charger work. Development of an electric thermometer is under way. A combination engine gauge unit for fuel and oil pressure and temperature has been constructed. Gasoline level gauges have been developed and one type put in production.

Considerable thought and a large amount of development work has been done on navigation instruments. The development of a more accurate altimeter is under way as well as one for photographic use. Another for use in landing in a fog is being worked up. The standard compass, type B, has been modified so that it can be read when placed above the pilot, as in the center section of the upper wing, and is known as the Type B Inverted Compass. Air-speed meters of the pressure type are being developed to use a Pitot instead of the customary Pitot-Venturi tube. Several models of air sextants have been developed and tested.

An accurate barograph for high altitude work, using a syphon for the pressure sensitive element, has been developed. This has also been equipped with a mechanical movement which enables the pen to make double traverse of the drum, giving twice the scale length of ordinary barographs.

Rate-of-climb indicators have been developed by the Bureau of Standards and by the Pioneer Instrument Co. The Prouty oxygen regulator has been improved and put into production. Development work is being carried on with a view to utilizing liquid oxygen in airplanes.

Radio Equipment

It is expected the Signal Corps, which is charged with the development of radio sending and receiving sets, will develop a lightweight sending set for pursuit planes. In the development of accessories, with which the Air Service is charged, radio control is the problem being worked on, for use in the handling of manless airplanes or aerial torpedoes. Radio control is being placed in an airplane for test. The pilot can allow the radio mechanism to control the craft or throw it out of gear at will. An automatic transmitter and selector permits any one of twelve distinct controls to be put into operation. Radio control necessitated the development of an automatic stabilizer.

Automatic Stabilizer Wanted

McCook Field states that there is no successful automatic stabilizer on the market today "which will operate satisfactorily, hence we were compelled to undertake the development of one."

Radio control with secrecy of transmission and reception is the goal.

Aerial Photography

Study is being made of improved methods for holding a camera vertical when the picture is being taken. Aid is being given by the Bureau of Standards, the Sperry Gyroscope Co. and a Doctor Gray of Scotland.

A mobile photographic laboratory is being developed as well as a railroad car type. A new experimental camera with 36-inch lens has been made with which negatives with good detail are expected from 30,0C0 feet.

Radio in Navigation

"The development of radio aids to aerial navigation are very important," says the McCook Field report. "We now have a homing which allows us to fly directly toward a transmitting station. We are also experimenting on a method of directive transmission which will establish a radio line in any given direction down which a pilot may fly, even when above the clouds or in a fog." Experiments are anticipated, also, for a landing field localizer to assist the pilot in alighting in a fog.

"Radio makes it possible for the pilot to find out what the weather is on the course he desires to fly and while in the air. This enables him to avoid storms .....Attention is being paid to the marking of various towns in the United States .....and aerial lighthouses are being tested." One branch of the equipment section is experimenting with these operated by acetylene gas, automatically flashing.

Miscellaneous Development in Equipment

Improvement in parachutes is considered still desirable. The solution of the fire risk problem still remains at the head of the list. Flotation gear and means for releasing the wheels of the airplane have been devised. A fairly satisfactory portable engine cranker has been designed and put in production. A portable take-off mat, of two types, has been experimented with. One consists of a woven rope net covered with canvas and the other consists of canvas mats with hickory slats inserted therein. The latter seems better. These mats will permit take-offs from muddy fields.

With the development of the supercharger came the demand for improved oxygen apparatus. The regulator known as the Dryer type is designated as "clumsy" and the Prouty has at times been inoperative so that it was necessary for McCook Field to design its own, using liquid oxygen and there has been installed a machine for reducing oxygen to a liquid state.

Work is going forward on a "unit flying suit," combining in one piece, moccasins, flying suit, helmet, face mask and goggles. It may be presumed, of course, that there will be room for a pocket flask. Non-fogging and frost-proof goggles are being sought. Experiments have been conducted with goggles having a partial vacuum between two lenses, and with goggles electrically heated.

An air-tight pilot's cabin has been constructed in a USD9-A for use at high altitudes. Ground level pressure within the cabin is maintained by means of a gear-type fan for driven air compressor.

Improvements are being tried in the clasping mechanism for safety belts. Other work is being done on life preserver cushions, observer's message holder, mechanical telautograph, towed targets, map cases and special machine shop trucks, airdrome illuminating trucks, trucks for aerial photography, radio, gasoline, etc.

McCook Has Practical Fire System

McCOOK Field announces that the equipment section of the Engineering Division of the Army Air Service is "developing a fire extinguishing system that it is believed will prove practical."

Of 1250 crashes investigated by flight surgeons in the period from the declaration of war to the end of 1919, 4.6 per cent were crashes in which fire occurred, either in the air or on the ground after alighting. For 1920 the percentage increased to 5.1 while for 1921 the percentage was 7.9. Last year 8.6 of the investigated crashes were fires, and of these 7.4 per cent occurred after landing, according to the best information obtainable. Of course, the 2159 crashes investigated were not all that occurred, nor were they all necessarily fatalities.

Fire in the air is a risk with which we may always contend. But it does seem particularly unfortunate that in a crash which otherwise might mean but a broken leg, or cuts, must cost a life for want of a fire preventative after the machine actually gets on the ground. Flying may have its risks but, after all these years, there would seem to be little excuse now for fires on the ground, after landing.

However, "a great deal of effort has been put forth to prevent the occurrence of fires in the air as well as fires resulting from crashes," says the report. "Considerable remains to be done along these lines before the situation is satisfactory."

The following apparatus is in course of development.

Leakproof and fireproof tanks, of metal covered with a combination of fabric and rubber. "These tanks have been but recently developed," says McCook. "It is expected that much more work will be done on the further development of these tanks. At present they are somewhat objectionable, due to the added weight involved, as well as their cost, and also the rapidity with which they deteriorate."

Crash-proof tanks, covered with material either inside or outside which renders them less likely to split and allow the contents to escape in case the airplane crashes.

"Many aviators," adds McCook, "have been burned to death from this cause alone. Several instances are on record where the aviator has had a slight crash which caused the tank to split and dash the gasoline over the hot *motor* (sic.) This has ignited the whole wreck almost instantaneously. In some cases the aviator has been unable to get out, due to being caught in the wreckage, and, in some instances, he was rendered temporarily unconscious by the shock of the crash and burned to death before he could be gotten out of the wreck."

"Some" instances is right. Twenty fires last year after crash, and 20 the year before that, in investigated crashes. However, it does not necessarily follow that these resulted in fatalities. The figures are not at hand for this but could, of course, be ascertained.

Then there are fire extinguishers and fire-extinguishing systems mentioned in the report.

"At present the only fire extinguishers carried on an airplane are the small hand operated type with a capacity of about 1 quart. These extinguishers are only useful to put out small fires that occur when the airplane is on the ground. In the air, they are practically useless, due, principally to the fact that the slipstream carries away the fire-extinguishing fluid discharged, which, normally, would blanket or suffocate the flames. In addition to their limited use, they require both hands to operate. The pilot must have at least one hand free for the control of the airplane.

"There is now in course of development by the equipment section a quart-size extinguisher that can be held and operated with one hand. It is hoped that this pistol type extinguisher may be found efficient in the air as well as on the ground, especially on ships that can not carry the weight of a complete fire-extinguishing system.

"The equipment section of the Engineering Division is also developing a fire-extinguishing system that it is believed will prove practical. It is now being installed in one of the training type airplanes. This system is built into the airplane and floods the engine compartment with extinguishing fluid under pressure. It is operated by a lever from the cockpit or will operate automatically under certain conditions. In case of a severe crash, the tank, located under the engine bearers, will be smashed, thereby allowing the fire-extinguishing fluid to vaporize over the engine and probably render fire less likely in event the gas tank splits and pours its contents over the motor. The carbon tetrachloride readily mixes with the gasoline vapor and renders the charged air less volatile.

"It may be found an advantage to combine the fire extinguishing fluid tank with the fire wall. That position, between the engine and the gas tank, might permit the extinguishing fluid tank to act as a buffer in case of a crash; in any event, its contents would reach the motor before the gasoline and possibly prevent a fire."

In a test already made of this system "a derelict plane provided with a Liberty 12 engine and propeller was used. In order to get a fire of intensity similar to what might be expected in the engine compartment oiled rags were placed around the carburetor; several gallons of gasoline were poured over the engine; and, after starting the motor, the combustible material was fired. For 10 seconds the fire was allowed to burn before the extinguishing system was turned on. It required about 6 seconds to extinguish the fire, using about 8 pints of carbon tetrachloride. Aside from fusing parts of the carburetor no material damage was done, although the engine was run at full throttle in order to simulate the slipstream of a ship afire in the air.

"Investigation is now under way of the possibility of fire in a crash caused by the exhaust manifolds being heated beyond the danger point. It is believed possible that some other metal, as aluminum, which rapidly cools and may be kept below the danger temperature, by using fins or giving the exhaust manifold more radiating surface, may relieve the situation. If we can combine freedom from the danger of fire from this source with an absence of glow in night flying, considerable satisfaction will be felt."

One can certainly vouch for the fact that "considerable satisfaction" will be felt by more than one pilot who has sideslipped to put out a fire. The eight plus per cent have nothing to say.

The New Wind Tunnel at McCook Field

By J. C. Branham

A NEW wind tunnel, which will afford much more convenient aerodynamic facilities than have hitherto been available, has recently been completed and put in operation at McCook Field. The use of this method of testing rapidly increased during a few years prior to 1920, and in that year the outside contracts under this item amounted to $30,000. In consideration of this annual outlay, and of the inconveniences resulting from having some of the tests made at distant points, it was found desirable to erect a new tunnel. Construction was begun in June, 1921, and the tunnel was completed in the summer of 1922. Since that time the plant has been in continuous operation, evaluating coefficients of aerofoils, model airplanes, etc.

The tunnel is 96 feet in length, with an airstream 5 feet in diameter, and requires the exclusive use of a standard 140 ft. Hangar. It is not a large tunnel when compared with some of those being used abroad. The size of the power plant, however, makes possible an unusual speed capacity, with a maximum of 275 miles per hour. The power plant was designed to use electric motors already on hand, so that the only outside purchase necessary was the motor generator equipment. Each of the two fans is driven in tandem by two Sprague dynameters, which were reserved from testing equipment formerly used for Liberty engines. Economy of first cost was thus achieved together with efficiency of operation.

Wind tunnel testing deals with the air forces of support, resistance and balance. Scale models are constructed of airplanes, dirigibles, wings, etc., the weight and material of which are of minor consideration. When these are mounted in the airstream of the tunnel, air forces arise the effect of which on the model can be measured. By applying "scale corrections", which are often small, the wind tunnel characteristics of the model furnish a reliable basis upon which to predict the flight performance of the full-size airplane. The Wright Brothers were the first to apply this principle to aerodynamic research; it was a vital step in their experimentation twenty years ago, as the design which finally gave them success was one previously determined upon by means of a small model in their wind tunnel.

A delicate balance, capable of measuring forces to one ten-thousandth of a pound, is located beneath the tunnel. This balance was built by a well-known manufacturer of telescopes, the design being based on an English type. A new wire balance for use at the higher speed ranges will soon be built.

The recent test of the Barling Bomber may be cited as an example of the method using the tunnel. A 1/70 scale model, complete with the exception of propellers, was made in the pattern shop, the rudders, ailerons, elevators, etc., being movable. A series of tests was then made to determine the degree of stability, together with the lift and resistance. The rolling, pitch and yawning tendencies were measured in inch-pounds with the control surfaces in various positions. From this data it was possible to predict the proper tail setting and the probability of easy control for the full-size airplane.

Operation of the tunnel requires precise physical laboratory methods throughout. There are many possible sources of error, any one of which may effect the results. A wind tunnel may be considered as the chief "Instrument of Precision" in the designers' hands. Since the object is to reach accurate conclusions in matters of design of new ships prior to the trial flight, the smallest details assume importance. For example, the direction and velocity of the atmospheric wind affect the readings of instruments inside the tunnel building. A similar effect is noticed, due to disturbance in air flow, when doors are opened, or when persons move about inside the building. It is for this reason that the doors are usually kept locked during a test.

A test represents about one percent or less of the total cost of a new experimental airplane. If a novel and untried design be shown by wind tunnel tests to be faulty, it is apparent that, neglecting engineering costs, 99 per cent of the project cost is saved, as compared with trial by actual flight. Again, when a new design is developed and perfected in the wind tunnel, as was the case in the early Nieuport monoplanes, the value of such test may be taken as equal to the cost of one completed experimental airplane, including engineering and overhead costs.

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Army Air Service and War Department

922 Special Inclinometers and Turn Indicators for Aerial Navigation, 1919
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639 Technique of Liaison in Battle, The 1917
*909 Theoretical Courses on Aeronautics for Airship Pilots, 1919 .10
956 Training in Aerial Range Finding, 1919
958 Training in Deflection of Aerial Gunnery, 1919
906 Treatment of Airplane Wing Coverings, 1919
*937 Trouble Shooting for Airplane Engines, 1919 .10
*940 Use of Mechanics' Hand Tools, 1919 .05
912 Utility of Airplane Instruments, 1919
643 Utilization and Role of Artillery Aviators in Trench Warfare, 1917
932 Valve Timing for Airplane Engines, 1919
975 Vickers Aircraft Machine Gun, Model 1918
833 Wing Tip Flare, Mark I—Description of, 1918
352 Performance Test of Navy Vought

Miscellaneous Government Publications

The following is a list of miscellaneous publications relating to Military Aeronautics, published or issued by the U. S. Army Air Service during the World War and subsequently no stock of these exists, this list having been compiled in order that those interested in any particular subject may have at least a reference to copies on file.

A. E. F.

French-English Aeronautic Dictionary, A Practical, Part I & II. (A.S. Information Section).
Manual of Initial Equipment and General Information for Service Squadrons in the Air Service, A.E.F., 1918
Notes on Branch Intelligence (1919) General Staff, A. E. F.
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Ring Sight. Air Service, Training Section. (Lecture by Capt. J. A. Cooper, R.F.C.) A.E.F.
Signal Communications for All Arms (1919)
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Spare Parts for Airplanes, Lists of:—
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Breguet XIV A2 as furnished by the French Government
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Nieuport XXVII as furnished by the French Government
Nieuport XXVIII as furnished by the French Government
Sopwith A2—B2 as furnished by the French Government
Spad XI A.2 as furnished by the French Government
Spad XIII CI as furnished by the French Government
Spad S VII as furnished by the French Government
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Clerget 130 H.P. Type 9B Monomotor Airplanes as furnished by the French Government
Gnome 150 H.P. Types 9 NB, NC Monomotor Airplanes as furnished by the French Government
Hispano-Suiza 180 H.P. Type 8-AB Monomotor Airplanes as furnished by the French Government
Spare Parts for Engines (Contd.)
Hispano-Suiza 200 & 220 H.P. Monomotor Airplanes, etc.
LeRhone 120 H. P. Types JBY & JBC Monomotor Airplanes, etc.
Pengeot 220 H.P. Monomotor Airplanes, etc.
Renault 150/170 H.P. Type 8-GB Monomotor Airplanes, etc.
Renault 190 H.P. Monomotor Air-Planes, etc.
Renault 190 H.P. Monomotor Airplanes, etc.
Salmson 9-ZM, H.P. Monomotor Airplanes, etc.

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English-French Glossary of Aeronautical Terms, 1918
Instructions for Installation of Type L Cameras on Airplanes, G.P.O., 1918
Notes on Rigging for Air Mechanics, 1917. G.P.O., 1918.
Theory of Ballooning by Griffith Brewer. (A course of Four Lectures on the Theory of Ballooning, delivered before Officers at the Royal Naval Air Station, Roehampton).
Training Manual No. 2, 1917. Gibson Bros. Press Inc., Washington.

BUREAU OF AIRCRAFT PRODUCTION

AC Titan Airplane Spark Plugs—Liberty Engine Service Bulletin No. 4, Nov. 2, 1918. Detroit District, A.S., B.A.P.
Carburetor Air Intake—Liberty Engine Service Bulletin No. 2, Nov. 2, 1918. Detroit District, A.S., B.A.P.
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Carburetor Gasoline Strainer—Liberty Engine Service Bulletin No. 3, Nov. 2, 1918. Detroit District, A.S., B.A.P.
Handbook of Aircraft Armament, 1918. G.P.O.
Information for Inspectors of Airplane Wood—prepared at the Forest Products Laboratory, U. S. Dept. of Agriculture, 1918.
Liberty Engine Storage—Liberty Engine Service Bulletin No. 9, Dec. 21, 1918—Detroit District, A.S., B.A.P.
Oil Pressure Control—Liberty Engine Service Bulletin No. 8, Nov. 23, 1918—Detroit District, A.S., B.A.P.
"Olive" Oil-Hose Liner—Liberty Engine Service Bulletin No. 5, Nov. 9, 1918—Detroit District, A.S., B.A.P.
Vertical Shaft Packing Nut Lock—Liberty Engine Service Bulletin No. 6, Nov. 16, 1918. Detroit District, A. S., B.A.P.
Water Pump Impeller Puller—Liberty Engine Service Bulletin No. 7, Nov. 16, 1918. Detroit District, A.S., B.A.P.

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Balloon Observation and Instructions on Work in the Basket, Aug., 1918.
Balloon Terms, Their Definitions and French Equivalents, Revised, June 1, 1918.
Construction of Balloons, March, 1918.
Interpretation of Aeroplane Photographs, Notes on the (Reprint of Third Edition) G.P.O., 1918.
Motor Trouble Shooting (1919).
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Vocabulary of French and English Balloon Terms. 1918.

ENGINEERING DIVISION

Airplane Designers, Handbook of Instructions for (1920)
Airplanes—D.H.4.—Illustrated Parts List for (1920)
Airplanes—J.N.4.-H and J.N.6-H—Spare Parts List for (1920)
Airplanes—S. E. 5.-A—Illustrated Parts List for (1920)
Airplanes—Thomas Morse S.4-C—Illustrated Parts List for (1920)
Applied Aeronautics, 1918.
Bulletin of Airplane Engineering Dept., Vol. I, No. 1, June, 1918
Bulletin of Airplane Engineering Dept., Vol. I, No. 2, July, 1918
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Bulletin of Airplane Engineering Dept., Vol. II, No. 1, October, 1918
Bulletin of Airplane Engineering Dept., Vol. II, No. 2, November, 1918
Bulletin of Airplane Engineering Dept., Vol. II, No. 3, December, 1918
Bulletin of Airplane Engineering Dept., Vol. II, No. 4. January, 1919
C. C. Interrupter Gear, Handbook on (1920)
Engines—Hispano-Suiza Model H, Illustrated Parts List on (1920)
Engines—Hispano-Suiza Model E & I, Illustrated Parts List on (1920)
Engines—Liberty "12"—Illustrated Parts List on (1920)
Forces in Diving and Looping. Reprinted from Bulletin of Airplane Engineering Dept., Vol. I, No. 1, June, 1918.
Full Flight Performance Testing. Reprinted from Bulletin of Airplane Engineering Dept., Vol. I, No. 2, July, 1918.
Handbook of Instructions. Reprint of British Document of Ministry of Munitions. For designers and contractors. (Use of Standard Material and Parts—Jigs and Interchangeability—Approval of Design—Checking of Centre of Gravity—Structural Strength—Wiring and
Handbook of Instructions (Contd.)
Attachments—Fabric and Dope—Prevention of Corrosion and Decay—

Engineering Dept., Vol. I, No. 1, June, 1918.

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Aeronautical Terms. G. P. O., 1918.
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Equipment for Aero Units of Aviation Section, Signal Corps. (Tentative) 1916
Heavy Aviation Truck, Parts List for
Identification of Airplanes, Notes on
Instruotion Manual—Instruments—Technical Notes. Air Information, March 1, 1918.
Instruction Manual on Motor Transport Equipment. Aviation Section, Signal Corps.
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Pilots and Crews, Notes and Rules for, 1917
Signal Corps Training Manual, Part I. Aviation Section, Signal Corps, 1917.

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Auxiliary Range Corrector Scale for Infantry, An. By Capt. H. E. Eames, 28th Infantry. Reprinted from "Infantry Journal" July-August, 1915. Bausch & Lomb Optieal Co., Rochester, N. Y.
Aviation Camera, Type "L", American Model—Manual of Instructions for
Cameras—Type DR-4, Aviation. Burke and James
Conventional Map Signs—British and French, Jan. 1918, U. S. Geological Survey.
Delco Parts List—Liberty Ignition—Dayton Engineering Laboratories Co., Dayton, Ohio.
Duties of Pilots and Observers, Lectures on. A. S. Aeronautics. Compiled by French Aviation Mission—Hdqrs. 1st Reserve Wing, Mineola, L. I., N. Y., October, 1918.
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Fighting in the Air by Maj. L. W. B. Rees, R. F. C. & R. A. National Special Aid Society, N. Y. C. Press of Gibson Bros., Inc., Washington, D. C.
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Gun Camera, Mark 1, Manual of Instructions for. Eastman Kodak Co., Rochester, N. Y.
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Lewis Automatic Machine Gun, Air Cooled, Gas Operated, Model, 1916, Savage Arms Co., Utica, N. Y.
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Marlin Aircraft Machine Gun—1917—Ordnance Department.
Metric Manual for Soldiers—Dept. of Commerce, Bureau of Standards. Miscellaneous Publications No. 21, 1918.
Notes on Artillery for the Use of Balloon Observers (Including Translation of Lectures delivered at the French Army Balloon School)
Practical Flying Hints—by Federico Semprini, Instructor—Military Aviation Camp, Foggia Sud—Italy. (1918)
Problems of Aeroplane Improvement, Naval Consulting Board (1918)
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Technical Notes, University of Ill. (1918)
Training Manual in Topography, Map Reading and Reconnaissance. Prepared by Major George R. Spaulding, Corps of Engineers, G.P.O., 1917.

Letters of Instruction

"Letters of Instruction" are issued from time to time by the office Chief of Air Services.

1919

1. Failure of Aluminum Aileron Control Quadrants in Curtiss JN4H and JN6H airplanes, April 8, 1919.
3. Surplus Maintenance Equipment and Supplies, May 9, 1919.
10. Radio Training, August 23, 1919.
11. Failure of Curtiss JN Stick Control Elevator Walking Beam Crank Arms. October 27, 1919.
12. Loosening of Fabric on Airplane Wings near Fuselage, October 27, 1919.
13. No. 1 Changes, DH4 Airplanes. October 27, 1919.
14. Gasoline Strainers for Liberty Engine Carburetor, December 18, 1919.

1920

1. Gasoline Strainers for Liberty Engine Carburetor. Amendment of letter of Instruction No. 14, relative Gasoline Strainers for Liberty Engine Carburetor. January 14, 1920.
3. Shipment of Airplanes and Airplane Engines to Repair Depots, Engineering Instructions No. 2. February 5, 1920.
4. Airplane Engine Heaters, Engineering Instructions No. 3. February 17, 1920.
5. Gasoline Line Hose Connection on DH4 Airplanes, Engineering Instructions No. 4. March 5, 1920.
6. Internal Drag Trussing DH4 Airplanes, Engineering Instructions No. 5, March 6, 1920.
7. Radio Vacuum Receiving & Transmitting Tubes. March 29, 1920.
8. Installation of Compasses on Airplanes for Cross Country Flying, Engineering Instructions No. 6, April 12, 1920.
9. Improvements to Liberty Engines, Engineering Instructions No. 7. April 13, 1920.
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11. Improved Gasoline Olive or Hose Liner for DH4 Airplane, Engineering Instructions No. 9, May 25, 1920.
13. Instructions for Installing and Operating the R-P Motor Oil Purifier, Engineering Instructions No. 10, June 19, 1920.
14. A classification of parts that Belong to Engine and Plane when Liberty Engine is Removed from DeH Plane, Engineering Instructions No. 11. October 6, 1920.
15. Storage of Delco Ignition Systems and Parts, Engineering Instructions No. 12, October 11, 1920.
17. Replacement of unserviceable Crankcases, Engineering Instructions No. 13, November 5, 1920.
18. Equipping DH-4 and DH-4B Airplanes with Spare Wheel Carrying Device, Engineering Instructions No. 14, November 15, 1920.

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1. Authorized Lubricants for Aeronautical Engines. Engineering Instructions No. 15. February 23, 1921.
2. Balloon and Airship Instructions No. 1, March 9, 1921.
3. Cylinder Valve Operation and Maintenance. Balloon & Airship Instructions No. 2, March 9, 1921.
4. Cylinder Maintenance. Balloon & Airship Instructions No. 3, March 9, 1921.
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7. Rules for operating DH-4 airplanes with 300 H. P. Wright Engine. Engineering Instructions No. 18, April 18, 1921.
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9. Comparative Value of Filtering Mediums for Gasoline. Engineering Instructions No. 20. April 28, 1921. Supplementing Circular Letter No. 61, December 4, 1918.
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11. Static tests of SE-5A Airplane. Engineering Instructions No. 22, May 10, 1921.
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14. Engineering Instructions No. 24—DH-4 and DH-4B Center Section Front and Rear Spar over Plate. June 7, 1921.
15. Engineering Instruotions No. 25. Elongation of Bolt Holes in the Wing Spars. June 7, 1921.
16. Engineering Instructions No. 26—Gunner's Control Stick on Airplane DH-4B. June 7, 1921.
17. Engineering Instructions No. 27—DH-4 and DH-4B Radiator Shutters. June 7, 1921.
18. Engineering Instructions No. 28—Instruction for Assembling Landing Gear on DH-4 and DH-4B Airplanes. June 7, 1921.
19. Engineering Instructions No. 29—Flexible Hose Connection. June 7, 1921.
20. Engineering Instructions No. 30—Carburetor Strainer Service Set, No. 2, June 7, 1921.
21. Engineering Instructions No. 31—Carburetor Duplex Air Intake (Service Set No. 3) June 7, 1921.
22. Engineering Instructions No. 32—Water Connections on Liberty Engines. June 7, 1921.
24. Engineering Instructions No. 34—Equipping DH-4 and DH-4B Airplanes with Spare Wheel Carrying Device. June 7, 1921.
25. Engineering Instructions No. 35—Shock Absorber Cord. June 7, 1921.
26. Engineering Instructions No. 36—Installation of Batteries. June 7, 1921.
27. Standard Air Service Method for Identification of Steels in Storage. June 8, 1921.
28. Repair of DH-4 and DH-4B Airplanes. June 8, 1921.
29. Engineering Instructions No. 37. Sims Magneto. June 8, 1921.
30. Engineering Instructions No. 37—Water Hose for Liberty Engine. June 8, 1921.
31. Engineering Instructions No. 38—Internal Drag Trussing DH4 Airplanes. June 8, 1921.
32. Engineering Instructions No. 39—Washer under Motor Arm Retaining Screw on Delco Ignition

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34. Balloon & Airship Instructions No. 5: Auxiliary Rigging Type R Balloon.
36 Engineering Instructions No. 40—Instructions on BMW Engines.
37 Engineering Instructions No. 41—Oil Grooves in Liberty Pistons.
38 Engineering Instructions No. 42—Water Pump Shafts.
39 Engineering Instructions No. 43—Key in Lower Ball Bearing Container.
41 Engineering Instructions No. 45—Installation and operation of Bijur, Rear End, Electrical Engine Starter.
42 Engineering Instructions No. 46—Maintenance of Airplane Starting and Lighting Storage Batteries.
43 Engineering Instructions No. 47—Inspection of Electrical Equipment and Adjustment of Fan Driven Generator Control and Protective Devices as installed in Airplanes.
44 Engineering Instructions No. 48—Thrust bearing on Liberty Engines.
45 Engineering Instructions No. 49—Draining of Oil and Gasoline Systems.
46 Engineering Instructions No. 50—Rejected Engine Parts.
48 Engineering Instructions No. 52—Defects in Pulley Attachment on DH-4 and DH-4B airplanes.
49 Engineering Instructions No. 53—Micarts Propellers.
50 Corrected Blueprints for Letters of Instruction Nos. 37 and 44, c. s.
51 Balloon & Airship Instructions No. 6—Type R Rip Panels.
52 Marking of Motors.
54 Balloon & Airship Instructions No. 7—Deflation of Balloons.
55 Engineering Instructions No. 55—Cleaning Radiators used with Liberty Engines.
57 Engineering Instructions No. 57—Safetying of Zenith Carburetor Drain Plugs.
59 Liberty Engine Changes—Historical Records.
61 Balloon & Airship Instructions No. 8—Blower Attachment to F. W. D. Truck for Air Inflation of Observation Balloons.
62 Engineering Instructions No. 59—Shipment of Airplane Engines.
63 Engineering Instructions No. 60—Draining of Intake Header Water Jackets on Liberty Engines.
67 Balloon & Airship Instructions No. 9—Method of Construction of a Brief Case for Observation Balloon Companies.
68 Engineering Instructions No. 62—Reinforcing landing gear axles.
70 Engineering Instructions No. 63—Zenith Carburetors.
71 Engineering Instructions No. 64—Delco Distributor Rotor.

1922

1 Lubricating Oils to be used in Aviation Engines.
2 Handley-Page Wheels on Standard DH-4 Type Airplanes.
3 Correction in Letter of Instruction No. 39, series 1921
4 Liberty Engine Water Pump Shafts.
6 Distributor Rotor as used on the Buzzer System on Liberty Engines.
7 Filtering Medium for Gasoline.
8 Handley-Page Wheels on Standard DH-4 Airplanes.
9 Ignition Switches for SE5 Airplanes
10 Safety Device for Universal Joint on DH-4 and DH-4B Stick Control Assembly.
11 Contact Points in Delco Breaker Arm.
12 Bijur Gear end Starting Equipment.
13 Installation of Generator Drive Shaft Assembly on Liberty Engines.
14 Gaskets Used in the Bellows (Sylphon) Type Fuel Pump.
15 Calibration of Magnetic Compasses on DH-4 Cross-Country Airplanes.
16 Submitting Samples for Test
18 Elevator Control Ball and Socket Joint on Curtiss JN Type Airplanes.
20 Propellers used on JN-4H and JN-6H Airplanes.
21 Control Stick on DH4-B Airplanes.
22 Liberty Thrust Bearing Retaining Nut.
24 Inspection and Storage of Wings.
25 Safety Belts.
26 Inspection on Propellers.
27 Propellers considered Best for Airplanes Shown.
28 Standard Spark Plugs for Aviation Engines.
29 Marking of Airplane Parts.
30 Propellers used on JN-4H and JN-6H Airplanes.
31 Reinforcing of DH4 Type Landing Gear Axles.
32 Damage to Hardwoods by Insects.
33 Mixing and Handling of Glue for Aircraft Work.
34 Reinforced Tail Skid Tube on all DH4 Type Airplanes.
36 Radiator Mounting—DH-4 Type Airplanes.
37 Protective Covering of Doped Airplane Surfaces.
38 Procedure to be followed in the Inspection and Maintenance of Air Speed Indicators.
40 Timer Head Lever
41 Camshaft Housing and Pressure Gauge Tube Assembly on Liberty Engines.
42 Fuel System Venting
43 Inspection and Care of Aircraft Engines in Long Time Storage.
44 Operation Troubles with Zenith U. S. 52 Liberty "12" Carburetors.
45 Liberty Engine Timing Gear Failures.
46 Damaged Engine Crankcases.
48 Spare Wheel Carrying Device for DH4 Type Airplane Using Handley-Page Wheels.
49 Oil Vents on DH-4B airplane.
50 Woodruff Key in Lower Ball Bearing Container.
52 Cleaning of Airplane and Airplane Engines.
53 Vertical Duplex Fuel Pump.
54 Symbol for Liberty Engines Equipped with Stub Tooth Camshaft Drive Gears.
55 Gunners control stick installation—DH-4B airplanes.
56 Engine Bed Assembly on DH-4 Type Airplanes.
57 Water Line Interferences—DH-4 Type Airplanes.
58 Liberty Engine Gear Inspection Hole.
59 Preparation of Engines for Temporary Storage.
60 Engine Symbols of Curtiss JNH Type Airplanes.

Selected "U" Stencil

Following is a list of those "U" Stencils published in the Office Chief of Air Service which are of an informative character. These are listed numerically and A. S. Library file numbers are given in parentheses.

1 Lewis Automatic Machine-Gun (X2969) D. M. A., 1919. Instruction Circular. 27 pp. (D72.1/Lewis/32.)
4 Liberty Engine—List of Parts of Intake Header Assembly. 1 p. (Old Information Circ. #32)
5 Liberty Engine—Propeller Hub (Old Information Circ. #33)
6 Liberty Engine—Carburetor. 1 p. (Old Information Circ. #34) (D-52.41/Liberty/201)
7 Liberty Engine—Generator Drive Shaft and Crankshaft Thrust Bearing. 1 p. (Old Information Circ. #35)
8 Liberty Engine-Timing. 1 p. (Old Information Circ. #36)
9 Liberty Engine—Cam Shaft and Gun Control Housing. (Old Information Circ. #37)
15 Liberty Engine, Order of Major Teardown. (Old Information Circ. #38)
16 Table of Spare Allowances; Maintenance 25 DH-4 Airplanes for 3 mos. (D52.1/DH4/7) See also U-40.
25 The Ruggles Orientator.
27 Flame Resisting Parachute Silk. Hy. A. Gardner. Aircraft Technical Note #93. (Balloon Bulletin #128-a).
40 Table of Spare Parts Allowance for maintenance of 25 DH-4 Airplanes for three months. 6 pp. (D52.1/DH4/7)
41 Table of Spare Parts Allowance for maintenance of 25 JN-4-D Airplanes for three months. 3 pp. (D52.1/Curtiss/31)
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98 Program for Air Service Training. 109 pp. (C53.2/50)
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ELEMENTARY AERONAUTICS and MODEL NOTES

Glider Contest

The first international soaring flight competition to be held in the United States between July 10 and August 15 will take place on the Pacific Coast. Oakland, California, has been awarded the meet by the National Aeronautic Association provided the city will raise its offer of $5,000 to $10,000 in prize money to the contestants. San Diego, Calif., is a contender for the competition and besides offering ideal conditions for glider navigation, promises to put up necessary prize money inducements. Capt. E. V. Rickenbacker, premier fighting "ace" of the American fliers in the World War, has donated a valuable trophy for the contest.

The Soaring Flight committee of the N. A. A., Orville Wright, chairman, after considering the claims of many localities for the glider contest, decided that Oakland offered the right conditions at Berkeley, northeast of the city, which has an unobstructed slope of three miles that has stood the test with a glider weighing 510 pounds. Wind and weather conditions at Berkeley average as near perfection as is possible to find anywhere in the country.

German, French and British gliders have promised to enter the American competition. "Few applications for the glider meet afforded right conditions," said Mr. Wright. "A broad, flat surface contiguous to a chain of hills so that the wind is deflected upward, is absolutely necessary. The sides of the hill must be practically free from obstructions, because the gliders take off on high ground and may be forced to descend at any point along the crest of the hill or in the valley. Expert pilots in good gliders are able to select their landing places," said Mr. Wright, "but we must encourage the amateurs, even if their machines are not of the best, by having the face of the hill and a long stretch of valley free from obstructions."

Gliding in Europe

In Germany the regulations for this year's competitions have now been published, the February issue of *Flugsport* being devoted almost exclusively to the forthcoming German competitions.

The Rhön Competition ("Rhön-Segelflug-Wettbewerb, 1923,") will take place from August 3 to August 14. This applies to the main competition. Running concurrently with this will be held a secondary competition for less experienced pilots, and this will last until August 31, while opening on the same day as the main competition.

In the main, the competition of this year follows the lines of those of previous years. The machines, before being admitted, must, in the case of the main competition, make a glide of at least 0.6 km. (0.37 mile), or of a duration of at least 60 secs. For the secondary competition, the corresponding figures are 0.15 km. distance or 15 secs. duration for machines controlled by shifting the weight of the pilot, and 0.3 km. or 30 secs. for machines controlled by flaps, elevators, and rudders. In addition, competitors must satisfy structural experts appointed by the organizers as to the strength of their machines.

The preliminary competition is for pilots who do not hold a pilot's licence for power-driven machines, but who do hold the licence A issued by the German Model and Glider Society (Deutschen Modell- und Segelflugverband). For the main competition, pilots who have no certificate for power-driven aeroplanes may be admitted by a test of 60 secs.' duration, during which two quarter-turns must be made, one left-hand and one right-hand. Holders of the class B certificate of the above mentioned Society are also admitted.

It is of interest to note that the Rhön competition will be open to other than Germans, although such admittance is confined to subjects of countries in which Germans are not debarred from taking part in competitions.

The Great Rhön Soaring Prize (Grosser Rhönsegelpreis, 1923) in the main competition will be awarded to the pilot who covers, in a single flight, the greatest distance in a straight line, with a minimum of 12 km. (7.44 miles). This prize is to the amount of one million marks. The first pilot to fulfil the minimum condition (12 km.) will receive 10 per cent. of the prize and each succeeding competitor who exceeds the previous distance by 5 km. will receive 5 per cent of the prize, these amounts to be deducted from the main prize secured by the ultimate winner.

First, second and third prizes, amounting to 300,000, 200,000 and 100,000 marks respectively, will be awarded for heights attained above the summit of the Wasserkuppe. The minimum height to be attained is 350 metres (1,150 ft.).

A third section is for distance covered in a straight line, open to all machines, with the exception that the machine and flight which win the great Rhön Prize do not count for this one. The flight will include taking into account loss or gain in height, as well as the actual distance covered, the following formula being employed:—

$$E = E_o - 8\,h_v + 12\,h_g$$

in which E is the distance figure on which the award of prizes will be based, E_o is the actual measured distance covered (in metres, presumably), and h_v and h_g are the figures representing loss and gain in height respectively (presumably in metres). The formula appears to work in the following manner. If a glide of 10 km. were made, and no account taken of loss of height, 10,000 would represent the figure on which the award was based. If, however, the machine dropped 1,000 metres during the flight (it does not appear that these figures refer only to the height of the alighting point, but to heights and "depths" reached *during* the flight) and at no time got up higher than its starting point the figure would be 10,000—8,000=2,000. If, during the flight, the machine reached a height of 500 metres above its starting point, the other figures remaining as before, the value of E would be 10,000—8,000+6,000=8,000. Presumably, the highest and lowest points reached count, so that if a machine does not drop below the point at which it ultimately alights, the height of that point will be the figure taken. Barographs are to be carried, and the gains or losses in height will be taken from their readings. The prizes in this section are 300,000, 200,000 and 100,000 marks respectively.

In the preliminary, or secondary, competition there are four groups of prizes, each of 120,000, 100,000, 80,000 and 60,000 marks for first, second, third and fourth prize. The competitions are divided into two sections, according to whether or not the pilots are holders of a license for motor-driven aircraft. The awards are the same in both classes, and the main divisions are for total flight duration and for duration in a single flight.

Herr F. J. M. Hansen, of Cologne, the designer of the Statax engine, has offered a prize of 100,000 marks for the first man to make a triangular flight of 45 km. side in a glider fitted with auxiliary engine. As a glider is considered any aeroplane which has remained up for a minimum of 10 minutes without motor power, the machine may have had an engine on board, but this must have been stopped previous to the timing of the 10 minutes glide. The engine used may be any petrol motor, not exceeding a capacity of 600 c. c. Two assistants will be allowed for starting, so that presumably there is no objection to the machine being started off from the top of a hill by rubber cords. Once in the air, however, it will have to proceed on its 84 miles flight without any other assistance than that which may be afforded by rising currents, gusts, etc. It seems likely that several of the machines competing for this prize will be fitted with the Statax motor described in our issue of November 23, 1922, which is within the cylinder capacity stipulated and is very light, weighing but 18 lbs., and developing 7.5 h. p.

(Concluded from page 285)

cial, industrial, legal and aviation experts" that shall "examine the steps practicable, both immediately and subsequently, to promote international development of civil aviation for commercial purposes." This advisory committee is to "maintain touch with any national or international organization concerned with air navigation so as to insure the closest collaboration, and that it exert means at its disposal to increase the interest of financiers and business men in this subject."

In presenting as a business man the view of forward-looking business men throughout the world relative to expediting communication and transportation for the advancement of commerce, Mr. Coffin emphasized the vital concern of all as patriotic citizens in the important questions touching the national security and welfare. "Aviation," he declared, "is the one outstanding mechanical heritage of the World War destined to influence for good the future relationships of mankind. Through aviation has come the realization of that dream of all ages, the conquest of the air and the conversion of this final and most baffling medium to the purpose of civilization as the speediest means of communication and of trade."

The difficulties of the commercial application of this new art were recognized said Mr. Coffin, but he asserted they would be overcome and in the end promoted by the demand of human-kind for a faster and more luxurious form of travel and transport. "Aviation," he said, "more than any other form of transportation is essentially international in character. The channels of operation lie through the free spaces of the air where movement is unhampered by political, artificial or natural barriers." No limitation is placed upon aviaton by frontiers, mountain ranges, oceans and rivers, or even continents, he declared, so that "if the slower forms of transportation have influenced civilization greatly and contributed to the welfare of nations, the benefits of commercial air navigation may be assumed beyond question."

Pointing out that aviation has forced the immediate need of a new code of procedure, of admiralty laws of the air, Mr. Coffin said: "In the realm of national defense no country can in future be secure against aggression unless it controls the air spaces above its territory. The creation and maintenance of the necessary air defense by nations is now inevitable. Now, whether this air defense is financed by direct appropriation sequestered from commercial activity and thereby lost to the constructive purposes of national life, or whether it is founded in large part upon the development of a commercially profitable civil aviation in the form of a 'merchant air fleet' may well engage the sincere attention of chambers of commerce of all countries."

Speaking for the American delegation, Mr. Coffin continued: "While for reasons of sound economics we favor the maintenance of adequate defensive machinery by each nation, we have certainly cast our influence against the excessive withdrawal of men and money from fields of production and trade. There is no doubt that air warfare has of itself put certain practical limitations upon both land and naval armaments, but no adequate effort has yet been turned to the limitation of the general direction of aviation as an offensive or defensive asset among nations.

Concluding with the endorsement of the support and approval from the American delegation of the recommendation that national funds be utilized to create a permanent and self-supporting civil air transportation, the congress without a dissenting voice adopted the resolution amid applause from delegates and spectators. The sub-committee which reviewed the world situation relative to commercial aviation and drafted the resolution was composed of Col. Frank P. Lahm, U. S. Army; Louis Breguet, France; H. James Yates, Great Britain; Col. Pier Ruggero Piccio, Italy.

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Council in any case in which an entrant obtains the consent of the Air Council to the test of the entrant's machine being held at some place other than that originally appointed by the Air Council) must be borne by the entrant.

18. Flying machines entered for the competition will at all times be under the charge and control of the entrant, and no liability will be accepted by the Air Council for injury or damage to person or property caused to or by the entrant of any machine or any person or persons having an interest in the machine or his or her servants or agents in connection with the competition.

19. The prizes in connection with the competition will be as follows:

Subject to and in accordance with the Conditions of the Competition:-

(I) A sum of £5,000 will be awarded in respect of test (a) named in Condition 4.

(II) A further sum of £15,000 will be awarded in respect of tests (a) and (b) named in Condition 4.

(III) A further sum of £20,000 will be awarded in respect of tests (a) and (c) named in Condition 4.

(IV) A further sum of £10,000 will be awarded in respect of tests (a) and (d) named in Condition 4.

20. The prizes named in Condition 19 will be awarded to the entrants of flying machines which are submitted for test in accordance with the conditions of the competition at the appointed time and place and which successfully and to the satisfaction of the Judging Committee appointed by the Air Council carry out the tests specified in the presence of and under the direction of the Judging Committee.

21. In the event of two or more flying machines successfully and to the satisfaction of the Judging Committee appointed by the Air Council carrying out any test or tests for which a separate prize is allocated under Condition 19 (I), (II), (III), and (IV) the prize allocated for such test or tests will be divided equally or in such proportions as the Judging Committee may determine between the entrants of the successful machines.

22. The Air Council shall not be bound to recognise any claim right or interest of any person or persons having an interest in any flying machine entered for the Competition other than the entrant of the machine and the receipt of the entrant shall be a sufficient discharge for any payment made by the Air Ministry in respect of any prize or share of a prize awarded.

23. No part of the above mentioned prizes will be awarded in respect of the helicopter now being constructed by Louis Brennan Esq., C. B. for and on behalf of the Air Council.

24. In the event of any of the prizes not being awarded such prize will again be offered for competition within a further period of one year from the date of the announcement by the Air Council of the result of the original tests upon terms to be then announced.

25. All communications in respect of the competition should be addressed to the Secretary, Air Ministry, Adastral House, Kingsway, London, W. C. 2.

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NEARLY NEW 160 H. P. Beardmore motor and radiator mounted in Standard fuselage with tail surfaces. Must sell. Sacrifice $275.00. Location Iowa. Henry Toncray, Scottsbluff, Nebr.

FOR SALE—New M. F. flying boats, less motors. Price $750.00. Charles Walher, Essington, Del. Co., Pa.

FOR SALE—Curtiss Seagull, K-6 motor, 150 H. P. perfect condition. Used as demonstrator. Fifteen Hundred Dollars, F. O. B. Packard Field, Detroit, Mich. Hunt Aviation Company, 845 Book Bldg.

FOR SALE—Flying boat Albatross (HS1L) in good condition. Price $2500.00. Write Brown, care Bunn Bros., 165 W. 45th St., New York City.

NEW THREE PASSENGER HISSO STANDARDS completely equipped in every detail $975.00 f. o. b. cars or in the air. For information wire or write, J. S. Schroeder, 5604 Washington Ave., Houston, Texas.

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FOR SALE—K-6 Oriole motor forty hours service. Complete 2 mags, carhuretor, self-starter and propeller huh. First cashier's check for $1000.00 gets it. Also 1 Oriole fuselage, 1 set wings and ailerons, 1 set tail surfaces, all complete, need new covering. 1 radiator. All the above in excellent condition. First cashier's check for $250.00 gets these. C. H. Siebenhausen, Box 144, York, S. C.

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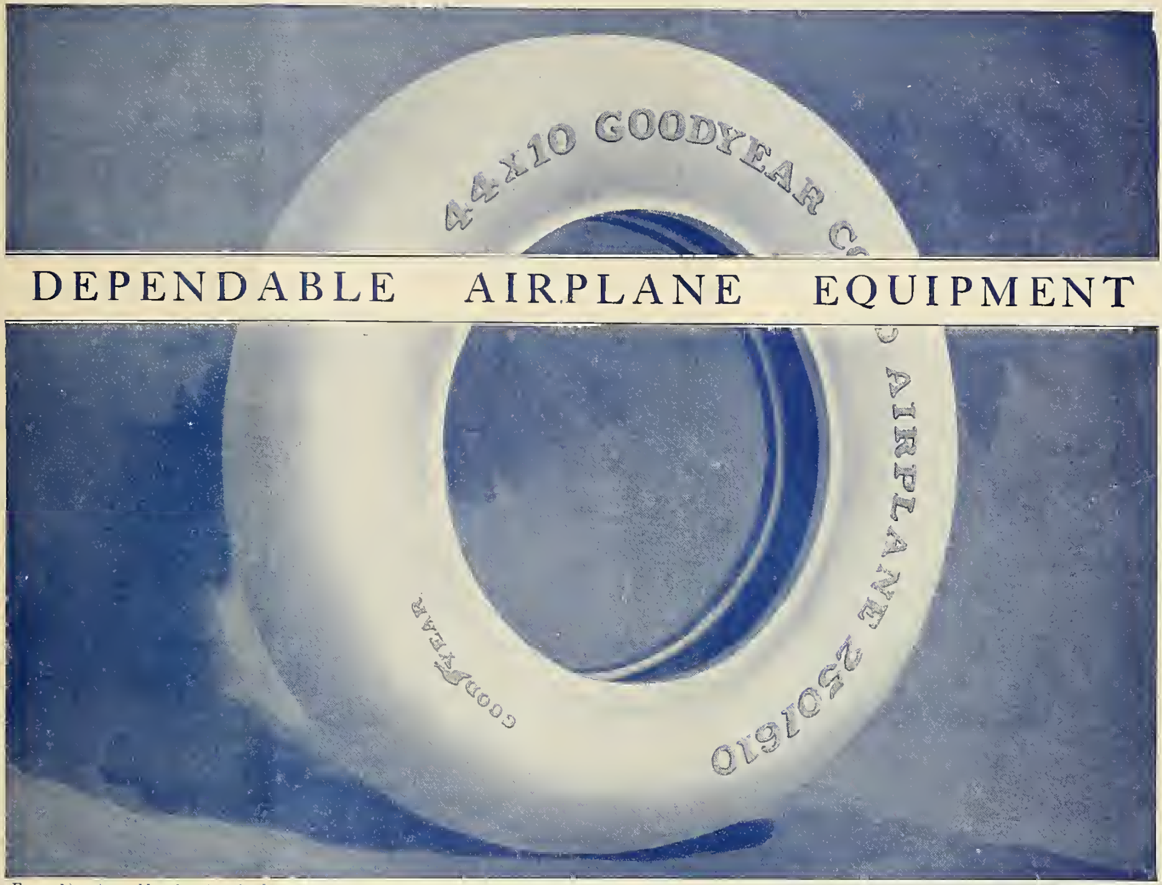

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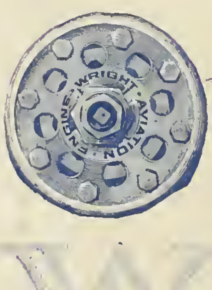

WRIGHT

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With which Flying *is consolidated*

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AVIATION EQUIPMENT

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Flying

WHAT sort of criterion have we at present for predicting the performance of an airplane before building it?

We have wind tunnel tests, of course, which are the only semi-scientific and semi-reliable sort of guidance that we can follow in the preliminary stage of the design of aircraft. We all know the many practical objections to wind tunnel tests which are reliable only if........and a good many ifs could be mentioned here.

Calculation is another method.—However, calculation in this case is a function of so many design elements that in order to find out the influence that the change of one of them has on the results, we must go through a long process of calculation, the outcome of which we fail to see at a glance.

A simple graphical method that would allow the designer of an aircraft to know at a glance what is the calculated performance of an aircraft in function of half a dozen or more variables entering in the project of a flying machine, would certainly be a very useful contribution to the development of aeronautics.

There are a number of graphical methods at present that can be used as a sort of rough guidance in the design of aircraft. None of them, however, is complete and none of them is based on a sound aerodynamical theory.

NOWADAYS, when every patron of aeronautics is willing to put up a cash prize for a trophy for a race, or for a model building contest, we would be glad to see somebody put up a $1,000 cash prize for a good, simple and reliable graphical method for predicting the performance of an aircraft when the design data are given.

A contest of this nature should be open to everybody in the United States and outside of the United States and the cash prize should be awarded to the originator of a graphical method of calculation based on sound aerodynamical principles. The results thus calculated must check up closely with the actual performance of a new type of aircraft which must be built and tested after the competition has been closed.

In our estimation, the thing could be managed this way:—One of our aircraft manufacturers designs a new type of aircraft, which he intends to build:—The dimensions and design characteristics of this new aircraft are used as a basis for issuing the competition:—A model of this aircraft is built and is tested by the National Advisory Committee for Aeronautics:—The competitors for the prize submit their graphical methods to the National Advisory Committee for Aeronautics and after the aircraft is built as closely as possible to the initial project it is also turned over to the N. A. C. A. which will test it and will award the prize to the winner of the competition.

This procedure would allow us to compare the results obtained from the best graphical method submitted by experts all over the world with the actual performance of the aircraft in flight, and furthermore, would allow us to compare both results with a wind tunnel test on the aircraft model.

There is no question about the great usefulness of such a competition. The question is—who is going to put up the $1,000 cash prize? Why not the aircraft manufacturer who designs and builds the aircraft tested? Why not the Aircraft Manufacturers' Association? Why not the National Aeronautic Association?

NIGHT flying is rightfully considered as the primary condition that must become an established everyday fact before commercial flying over long distances can successfully compete with the express train which can travel day and night.

This is quite true and we agree with the advocates of night flying that this must eventually be done. We cannot, however, agree with a good many impatient futurists who believe that all that is needed for establishing night flying is the building of a few light houses along the air routes.

Last February, a night flying test was made over the Paris-London line by a DeHaviland type G equipped with a Siddeley-Puma 240 HP motor and weighing 4,000 pounds. The maximum speed of this aircraft is 110 miles per hour and the landing speed 50 miles per hour.

The test was made under particularly severe conditions considering the weather at this time of the year over the British Channel. However, the results were not very brilliant. Of 24 scheduled trips between February 5th and 28th, only four could be completed, thus giving a percentage of only 17 per cent successful flights.

To fly in clouds in daylight is only disagreeable, but to fly in the clouds during the night is a more serious matter. Those who have been at sea on a fast moving ship and have suddenly found themselves in a thick fog in a pitch dark night know what this means.

However, while the stability of a ship in the water is assured, at any time, independently of the pilot, the stability of an aircraft in the air is entirely too much dependent upon the human equation represented by the pilot. This is true both in day and night flying; in the latter case, however, the matter is complicated by the additional strain on the pilot and consequently the probability of accidents are greatly increased.

Before we can have safe night flying, and as a matter of fact, before we can have any sort of comparatively safe flying, we must design and build an automatic stabilizer which will reduce the importance of the human factor in the performance of aircraft.

The development of a suitable automatic stabilizer will contribute more to the development of commercial flying than anything else that can be done at the present time in this direction.

Who is going to develop it?

THE article, printed elsewhere in this issue, on the status of aeronautics in France, will give everyone, who has the interest of American aeronautics at heart, food for thought. If a debtor nation can make such rapid strides as is indicated in M. Flandin's article, surely a nation with the resources of the United States can more rapidly utilize the advantages of commercial aeronautic development.

Col. G. Arthur Crocco Becomes A Member of the Editorial Staff of Aerial Age

AERIAL AGE is glad to announce that Col. G. Arthur Crocco, the well-known Italian aeronautical expert and an authority on dirigible construction, has been appointed Associate Editor of Aerial Age.

In 1903, Col. Crocco presented to the French Academy of Sciences a note on the stability of dirigibles, in which was given for the first time the basis for the calculation of the stability and damping effect of dirigibles. A gold medal was awarded by the French Academy of Sciences to the author, who later extended his method to heavier than air aircraft and published the first complete and original theory on "The lateral stability of airplanes."

In order to verify experimentally his theories, Col. Crocco built an aerodynamic wind tunnel and a Froude water tank, and later on founded the Central Aeronautic Institute in Rome, which is one of the best scientific research institutes in aeronautics in Europe.

Col. Crocco is the author of the well-known analytical theory on propellers, and he has been the first one to establish a rational basis for the aerodynamics involved in the operation of propellers. An application of his theory was made by the author when he designed and built the first variable pitch propeller for dirigibles and when he invented the breaking device for helicopters when landing without motor, which has since been adopted by Pescara in his helicopter.

In hydroplane construction also, Col. Crocco is a pioneer. In fact, the experiments made by him with the collaboration of Col. Ricaldoni and Col. Munari, and with the financial support of General Morris, on a hydroplane designed by him and a modification of the Forlanini design, were considerably in advance of similar experiments made by Graham Bell in the United States twelve years later.

During the war, Col. Crocco designed and built an automatic focusing device for guns operated on board of dirigibles, and with the collaboration of Col. Guidoni designed and built the *telebomba*, which is the most effective aerial torpedo so far produced. He is the inventor of the first automatic stabilizer for aircraft, and also of the first route indicator.

Col. G. Arthur Crocco

In spite, however, of the important work done by him in the scientific field of aerodynamics and in the engineering field of aeronautics, Col. Crocco is primarily an expert on dirigibles. In 1907, always with the enthusiastic support of General Moris and with the collaboration of Col. Ricaldoni and Col. Munari, he built the first Italian semi-rigid dirigible with automatic rudders. During the war he really created a lighter-than-air industry in Italy and built thirty dirigibles.

After the war, in collaboration with Usuelli and others, he built the "Roma", and has since established the basis for the development of the semi-rigid type, of which he is the most authoritative exponent.

Col. Crocco is also the author of a project for a rigid type of dirigible which has been responsible for a number of improvements in both British and German rigid dirigibles in which some of his ideas have been incorporated. We consider it a great privilege to have Col. Crocco on our editorial staff and we extend to him our cordial greetings.

The Observer's Column

America is taking up metal construction with a vengeance. There was Larsen and his J-L, the Wright company has filed an exhibit with the Navy, and now a new center of activity comes out with another example of home-grown products. When the observer came around, the fuselage was all made up nice and shipshape the engine had been installed and under the bow was stuck a piece of timber to take off any undue strains on the members while resting on the ground. But during lunch one day, so the story goes, somebody having taken away the scantling, the hull darn engine and mount fell through.

I don't know what this story illustrates, but it's a good story. The flying field needed another hangar so the engineers got together and worked out the stress diagrams and the movement of the c. of p. and the location for the bar and finally got the thing all up.

And when they had it finished, sure, it looked so sweet and fair,

"Suppose we take a DH, and put the old thing there."

The plane stuck by about two and a half feet, more or less, over and above the scheduled tolerance. "Oh well, isn't this an experimental field?"

Bolling Field is to have a new K. O., Maj. Wm. H. Garrison, Jr., Air Service, who will take command some time in June when he finishes his course at General Service School at Fort Leavenworth. Maj. Garrison was an officer of the Volunteers in the Spanish War, became a cadet at the Point and commissioned 2d. Lt., Cavalry in the regular establishment in 1908. He was made a temporary Major in 1917 and later commissioned permanently in his present rank. He is an airplane pilot, having learned to fly at Brooks Field, San Antone, in 1918.

Normally, a change in station isn't of importance to the majority of readers but Bolling Field is an exceptional field. Here it is that the Congressmen—Gawd bless 'em for the Volstead act—take their and their secretaries' rides, and the Chief of the Air Service flies and Admiral Moffet and where the manufacturers show their new machines, and so on.

Maj. B. Q. Jones, Commanding Officer of the U. S. Army Air Service in the Philippines has rather a unique way of saying things. He usually has something worth while to say, too, and knows how to say it. He's snappy and fast with the paper work and we like him. He used to say words were invented for the expression of ideas and if we claimed we didn't mean just exactly his opinion of what we said, he told us to say what we meant, then.

Well, anyway, B. Q. says that any airplane on his field that's fit for anyone to fly is fit for the C.O. No private planes for him. And he claims to be able to fly any plane on the field.

There's 600 plus expendable Second Lieutenants in the Air Service Officers Reserve Corps for every Colonel, and there's 10 Colonels, 20 Lieut.-Colonels, 152 Majors, 650 Captains and 1314 First Looies.—8165 in all, including 19 extra Second Loots left over from the ratio first-above mentioned.

The regular Air Service establishment numbers 873 souls commissioned in that arm. The Second Looies here number but 74 and the Firsts 556; 139 Captains, 88 Majors, 12 Lieut.-Colonels, 2 Colonels, 1 Brig.-General and 1 Major-General. Only 11 are non-flyers. Thirty-nine are flying but are not yet rated as either military aviator, airplane pilot, airship pilot, airplane observer or balloon observer. Brig.-General Mitchell and 3 Majors are now the only "military aviators"—the oldest rating in U. S. aeronautics. Airplane pilots number 707, of whom 67 are airplane observers in addition; and airplane observers total 9 (count 'em). Airship pilots number 50, all balloon observers as well. There's Jimmy Healey and 52 other balloon observers. On duty, but not a part of the Air Service, are some 40-odd flight surgeons.

The Wright all-metal pursuit plane has attracted a lot of favorable comment in Washington flying circles.

France has entered upon a realization of air supremacy. Her air forces are now four times larger than the air forces of Great Britain. She is now in world command of the air.

Gnome company, has purchased the French rights for the British air cooled radial engine of the British company. In *Aerial Age* for May it was argued by Lieut. Leighton, USN, that a 400 h. p. air cooled engined power plant would weigh 940 lbs. against the 400 h. p. Liberty's weight 1462 lbs.

France is following Germany in the development of all metal construction. Junkers is convinced that the metal plane, built of duraluminum, has great advantages for peace time flying. It is claimed for metal construction that passengers are not injured in crashes, that there is less depreciation, that the fire risk on crash is less. Ease of construction is another advantage. In crashes the members bend and twist but do not splinter.

According to the Army Air Service the Fokker monoplane used by Macready and Kelly in the new records takes 1 mile to get off with full load and 1 hour to climb 4000 feet. Spencer Heath says: "Tell 'em a universal propeller will take 'em off in 1400 instead of 5280 feet and will climb the 4000 feet in about 35 minutes instead of an hour."

Detroit is to have an air board. Brig. Gen. C. Godloe Edgar, chairman of the committee on organization, said that the board woud aid in:

1. Development of the science of aeronautics, including the design and use of aircraft, both lighter and heavier than air.
2. Application of aeronautics in all of its aspects to the National defense.
3. Development and organization of governmental agencies for the administration and control of commercial and civil aeronautics for the well being and safety of the general public.
4. Development of the jurisprudence of the air by which aeronautical transportation will be given a recognized position in the affairs of the country.
5. Development of the use of aircraft for purposes of commerce and facilities for making commercial transportation practical and a business possibility.

France—Mistress of the Air

Germany's Commercial Airways a Potential War Risk -- Commercial Aircraft the First Line of Defense -- Gas Bombs and Airplanes Make Stupendous Rifles -- French Appropriations Smallest but Greatest in Results -- America Outstripped by Smallest Nations -- The Sick Man of the East is Getting Well by Air

FRANCE leads the world in air transportation. This commercial application of the airplane keeps alive her factories, among which orders are widely distributed in order to nourish as large an industry as possible. The technical progress essential for the improvement of commercial air transport is just as essential for the development of aeronautics as a means of national security—defense if you prefer. Her military air force is now four times larger than that of England. This, added to her commercial possibilities, gives her world command of the air.

France has reason to be interested in air defense. Her late enemy, by whom she has been invaded every fifty years since before Christ, is but three hours away from her capital. The Versailles treaty hasn't disarmed Germany in the air. It is estimated that Germany today could equip an air force of 5000 airplanes during a "period of diplomatic tension" lasting eight or nine months. It is figured that at least seven months are needed by any nation to inaugurate an intensive manufacture of aircraft and their engines.

Pierre Flandin, a member of the Chamber of Deputies of France and head of the Aero Club de France, draws attention "to the fact that hereafter it will be possible to load on a single airplane (and he means everyday, commercial craft such as France and Germany and Sweden, Turkey, Denmark and Africa and other advanced nations, save America, are operating daily in passenger and express lines—*Ed.*) a complete section of machine guns, including personnel, material and supplies. Imagine a moment what three or four hundred sections of machine guns could do in the three hours following the opening of hostilities by landing suddenly near the most delicate points in the general organization of a nation. During several hours, at least, each one of these sections will be the complete master of a small portion of the territory which it occupies—stations, railroad bridges, dams, harbors, large factories, etc. While the machine gun is on guard, the destruction section will operate, and one must remember the formidable possible development of chemical warfare."

How much of the resistance of a nation could be broken in a few hours by an aerial force supplemented by another air force working on the morale of the population by the systematic bombardment of great cities, will be measured in the next war, wherever it occurs. Here is the first line of defense. Two can play at this same game. The country with air supremacy is doped out to win—at least, it's certain she'll be first away at the barrier.

The 200-pound bombs of the world war now give place to those of 2000 pounds. This weight of gas out-effects the same weight of high explosives. True, the late conference on the limitation of armaments signed something about using gas within the conference family, but the members are free to use it against the heathen non-members or inside the family if someone renegs. And the gas-carrying airplane has the long-range gun outranged by a hundred miles. Then there is the enemy's navy which may be reached by the suddenly drafted commercial airplanes—all providing the enemy doesn't do the same thing.

However, each country appreciates the airplane and airship and the one with the quickest, heaviest and longest punch is the one which will land first.

This means a race for aerial supremacy.

Facing the risk of Germany's quick change from commercial planes to those of war, France feels her only guarantee of safety is in the air.

M. Flandin, at the same time, wants it clear that it would be unjust to accuse France, because she is making such a great effort in the establishment and maintainance of her network of air transport routes, of embarking upon a course of aerial imperialism. He compares the respective budgets of England, the United States and of France to show that the two Anglo-Saxon nations devote more money to aeronautics than does France.

"Reducing all these credits to dollars and adding to them, it being well understood, all other expenses chargeable to military, naval or civilian aeronautics, we arrive at the following figures for 1922:

For Great Britain..... $72,000,000
For the United States.. 40,000,000[1]
For France........... 32,000,000[2]

"We are not then building an aerial fleet with the money which, although certain opinion suspects it, we should, it is said, devote to the payment of our debts. We are simply assuring our national security, working above all for the peaceful progress in the development of commercial air locomotion.

"We are proud to have been the originators of this movement and we are convinced that the day when the system of air transport extends over the entire world, facilitating understanding between peoples, and above all personal relations with the elite of all nations, we will have worked in the most efficacious manner to establish world peace, for nothing is so valuable as a direct contact of individuals in dissipating the misunderstandings and the ignorance which often separates nations, particularly when they are widely separated from each other."

Admitting that the main reason for the establishment of French air routes is political; that because of short distances, necessity for frequent landings for customs, the operation of lines to points which produce little or no revenue, where a strictly non-sub-

[1]The combined appropriations for Army and Navy Air Services, Air Mail and National Advisory Committee for Aeronautics for fiscal year 1922 was $34,063,431; for fiscal year 1923 was $29,493,590; and for 1924 was $28,843,174. Army and Navy figures include field civilian personnel but not pay of officers, enlisted men and departmental civil employes. P. O. figures include pay of air mail personnel and expenses of operating. NACA item includes pay of employees.—*Editor.*

[2]In considering the reduction of the various sums to dollars, there should be considered the actual purchasing value of the franc and the pound in munitions of war and the current rates of exchange. It has been suggested that the franc may be estimated at two and a half times its exchange value in the purchase of air material. This would, if true, change the French investment to $80,000,000 in reality.—*Editor.*

sidized commercial line would not fly, the lines are unprofitable from a money standpoint; that the Government pays 60 per cent of the expenses; the actual commercial possibilities are obviously being realized when we consider that over 582 tons of small express were carried last year by French air lines, and more than two million letters were sent at a triple postage rate and 14,397 persons were carried.

And the carriage of merchandise is increasing faster than the carriage of people. The passengers flown in 1922 were only 1 1/2 times those carried in 1921 but the goods transported increased over three times.

America, the land of the Great! Great distances, great cities, big business, the chosen land for air transport, splendid in its aerial isolation. An industry depending on military aircraft only for its existence with a greater field left untilled. And once they praised American genius and progress. Turkey is doing business by air. America looks complacent and buys a ticket on the Broadway Limited, while the puny nations of the earth are flying to work. Shades of Robert Fulton!

Facts and Figures on Commercial Air Traffic in France

BY PIERRE FLANDIN, PRESIDENT OF THE AERO CLUB OF FRANCE AND A MEMBER OF THE CHAMBER OF DEPUTIES OF FRANCE

Costs---Incomes---Regularity---Safety---Volume of Traffic---Air Traffic on the Increase ---May Be Cheaper than Steamship Travel but Dearer than Railroad---Subsidies Diesel-Type Engines Needed---France now "Mistress of the Air"

France has built the nucleus of a great system of air transportation which will bring together the nations of the earth through personal contact. World peace may result from this closer communication and better understanding. In the meantime, in addition to demonstrating the practicality of air transportation France is building national security by air and maintaining an industry. Here is what M. Flandin had to say to the American Club.—EDITOR.

IMMEDIATELY after the war the question arose: Is our magnificent effort in the perfection of technical aeronautics limited to war purposes or may it be applied to peaceful pursuits—in civil and commercial air locomotion?

Three essential questions had to be answered by experience in order that a solution of this problem of commercial flying might be reached.

The first was a question of the *safety* of air transportation. This is attested by the fact that 3,543,000 kilometers were flown by commercial airplanes, in 1922, over French commercial air lines with but three accidents recorded.[1]

The second question was that of the *regularity* of air transportation, i. e., the practical demonstration that a journey by air could be completed within a specified time with the same exactitude as it could by other means of transportation, such as railroads. Experience has demonstrated conclusively that air transportation is as reliable as ordinary modes of travel. For example, this regularity was 98% upon the French lines running into Morocco.[2]

The third question was that of *probable traffic*. The answer to this question may be found in the following tabulation:

Year	Kilometers Flown	Number of Passengers Carried	Kilos. of Express Carried	Kilos. of Mail Carried
1920	853,000	1,379	48,100	3,925
1921	2,353,000	9,427	166,490	9,481
1922	3,543,000	14,397	529,664	41,173
1923	*4,600,000*[3]			

This last figure (41,173 kilos. of mail) represents more than two million letters upon which the senders paid a postal surtax of at least three times the ordinary postage charge.

The increase of traffic is considerable, and it is undoubtedly true that we have not yet arrived at the peak of the curve and that the traffic will continue to increase. These results show that air transportation has found a serious freight to feed it.

I draw your attention particularly to the remarkable development of the carriage of urgent package mail which is becoming an extremely important source of income.

Can it be said that these receipts are sufficient to permit air transportation to develop freely and by its own resources without the financial aid of the State?[4]

No. For, summing up, the total of the commercial receipts for 1922, which were nearly 7,000,000 francs, corresponds to a commercial return of but 2 francs per air kilometer. Now, we must consider that the net cost of transportation per ton-kilometer is from 16 to 18 francs.[5] Our English friends, who recently charged a technical commission with the study of this question, have arrived at a figure, it is true, slightly lower—at the present rate of exchange 13.25 francs per ton-kilometer.

We believe, however, with the experience which we have had on lines extending great distances from their bases of supply and maintenance, that this figure is too low. One must not compare, therefore, without reservation, the cost per ton-kilometer with the receipts per air kilometer which I have just mentioned, for this figure was obtained by airplanes, the greater number of which transported but 500 kilos. of useful load.

The difference between the net cost of transportation, on one hand, and the commercial receipts upon the other, is shown to be less. Putting the matter in a better way, we can not, at present, do more than hope that the commercial receipts may cover one quarter of the operating expense.

[1]*It was stated in the Chamber of Deputies on Nov. 30, 1922, that in the first 11 months there had been 8 accidents in which 18 persons were killed and 3 injured.—Editor.*

[2]*The regularity of the U. S. Air Mail for 1922 was 95.52% of scheduled trips. The average for five years 90.39%. In August, 1922, it was 100%.—Editor*

[3]*Estimated by the Editor.*

[4]*The sum appropriated for subsidies in 1922 was 45,382,000 francs normally equal to $9,076,400.*

[5]*Taking 17 francs per kilometer as an average expense, the cost of operation was 60,231,000 francs for 7,000,000 francs commercial income, which is about 11.6% of the expense; in 1922.*

Does this mean that one must despair of balancing receipts and expenditures of air transportation, and that State subsidy must remain indefinitely a necessity? I do not think so.

Beyond question, in spite of the development of the traffic, the majority of the lines operated last year at half capacity.[6] If for each trip a full load had been carried, one could have hoped that the commercial receipts would have attained nearly 40% of the operating expense. May one believe that the remaining 60%, today compensated for by State subsidies, may be reduced in the near future? For my part, I am persuaded of it.

If I may refer to the studies which have been published by the Civil Aviation Advisory Board in England, as well as to the studies which we have made in France, we may separate the elements of net cost per ton-kilometer as follows:

Fuel	24%	
Personnel	20%	
Amortization and maintenance of material	30%	
Insurance ...... (of which 13% is carried on material)	18%	
General expenses and commercial publicity	8%	100%

It is certain that 30% for amortization and maintenance of material represents a formidable proportion, which is due to the fact that the construction of airplanes and, above all, of engines, has not attained to date a sufficient degree of perfection; but we may soon hope, thanks to the general tendency towards metal construction of airplanes and the improvement in the manufacture of engines and a better system of inspection and maintenance of material, that the amortization and maintenance may be reduced one half.

The cost of fuel, represents almost one quarter of the actual cost per ton-kilometer. We can, without doubt, hope that oil-burning engines using a less expensive fuel will one day replace the gasoline engines in use at present. However, in my opinion, this day is still far off and I await a more rapid improvement due to the increase of load in ratio to the horsepower utilized. For example, if I transport five passengers in an airplane driven by a 300 h.p. engine, I use 60 h.p. for each passenger; if I am able, with the same 300 h.p. engine, to carry ten passengers, I use but 30 h.p. per passenger and thus reduce by one half the fuel cost. This seems to me to be possible very soon.

This practical problem has been and is very attentively studied by the Germans. They were forced to this by the restrictive clauses imposed upon their aviation, but they also understood that it is a vital problem for the future of commercial air transport.

Finally, it is not to be doubted that, with experience in air transport, other expenses may be equally reduced, as well as the insurance charges which are based upon the cost of the material. We may then hope that the cost per ton-kilometer will be reduced in a few years to 8 or 9 francs instead of 13 to 16 francs as at present. When this result has been attained, counting each passenger with his handbag at 100 kilos., we arrive at a cost of 80 centimes to 1 franc per kilometer. It is worth while to compare this figure with the rate for French *trains de luxe* which is 37 centimes per kilometer; and also with the rate for steamship transportation—for example, from Marseilles to Bombay, which is 1.25 francs per kilometer. It is equally interesting to compare this cost with the actual air transportation rate between London and Paris, which is 80 centimes per kilometer, with a constantly increasing number of passengers. The swing in time realized permits us to state that this rate of 80 centimes per kilometer is not excessive as far as the passenger is concerned.

From this moment, air transport companies will be able to exist without the financial aid of the State. These enterprises will balance their budget still more rapidly if the air mail is generalized. Let us not forget that the weight of 100 kilos. represents 5,000 letters of 20 grammes each, average weight. Upon a route like that of the *Malle des Indes* our English friends estimate that a surtax of one shilling per letter would be willingly paid by the sender, which would represent a commercial return of 2 francs per kilometer for each 100 kilos. of letters over the total distance of 7,000 kilometers.

From now on, we may, then, consider that, due to the improvements which I have just mentioned, an air route between London and India could operate without subsidy and give an appreciable commercial return. In fact, the weekly total of mail between London and India is 150 tons, of which 10.5 tons are letter mail. Returning from India to London, the mail is less heavy; but counting only upon 20% of the letters going by air mail, each airplane could carry daily 300 kilos. of letters, which means 45,000 francs in commercial receipts. If the airplane is of the type actually generalized, i. e., carrying 1 ton of useful load and 4 comfortably arranged passenger places, counting only 3 out of 4 of these places being occupied at 10,000 francs each, a supplementary receipt of 30,000 francs is realized.

There will remain, in addition, transportation for light merchandise and newspapers, a weight of 300 kilos. This last transportation shows great importance between Paris and London and is sufficiently remunerative, constituting, in consequence, the profit of the company, the operating expense being covered by the first two items.

These calculations seem sufficient to justify the confidence which the public officials and the French aeronautical world have in the future of air transportation. They are, in addition, a justification of the sacrifices which the State has made to aid air transport companies to live. I know that in certain quarters, and notably abroad, there has been criticism of the French Government for the amount spent in the development of air locomotion, but I desire to state, in conclusion, that these sacrifices which are founded upon the possibilities of the future, have also their reason from the point of view of the national defense.

[6]The figures on income in this article can not be taken as indicative of what may be expected in America. France is operating lines between places where travel, mail and express is small in amount, for political or military reasons rather than for commercial returns. Commercial lines in America will follow the volume of traffic. —*Editor*

Navy Personnel Situation Will Affect Naval Aviation

Recent communication from the Bureau of Navigation calls attention to the fact that there will be an increasing shortage of personnel in the Navy for the next six months due to the excess of expirations of enlistments during that period over the normal rate. It is estimated that at the end of the calendar year the Navy will be from 8% to 10% short of its authorized complement. In spite of the fact that this shortage has been progressive of late, Naval Aviation has been generously dealt with. At the present time there is an excess of 400 men in the combined aviation units. During the next six months Naval Aviation will be required to reduce so as to bear its proportion of the shortage. This shortage will, according to present estimates, be corrected gradually beginning with the next calendar year, and will be wiped out in approximately two years.

New England Net-Work of Air Lines Contemplated

THE establishment of a network of New England airways to connect Boston with the other business and industrial centers and also with the summer resorts is a project now being undertaken by the Boston Chamber of Commerce. Plans are under way for the formation of local aviation committees in the principal cities and towns of New England and for the building of landing fields in the various communities.

The Chamber has been assured of the cooperation of the Army Air Service, which is doing much in the establishment of national airways, and of the New England District of the National Aeronautic Association.

Now engaged in working out the plan is a committee of Chamber members, the chairman of which is Colonel Edgar S. Gorrell of the Marmon Boston Company. The other members of the committee are: Porter H. Adams, engineer; George Bramwell Baker, of Baker, Young & Company; W. Irving Bullard, vice-president of the Merchants National Bank; Emery Haseltine, of Kimball, Russell Company; and James T. Williams, Jr., editor of the *Boston Transcript*.

The recommendation of this committee that an active campaign be conducted for the establishment of a system of airways in New England has been approved by the Board of Directors of the Chamber, and the committee has been granted authority to make all arrangements. It has already obtained the names of persons who are interested in promoting the plan in their different communities.

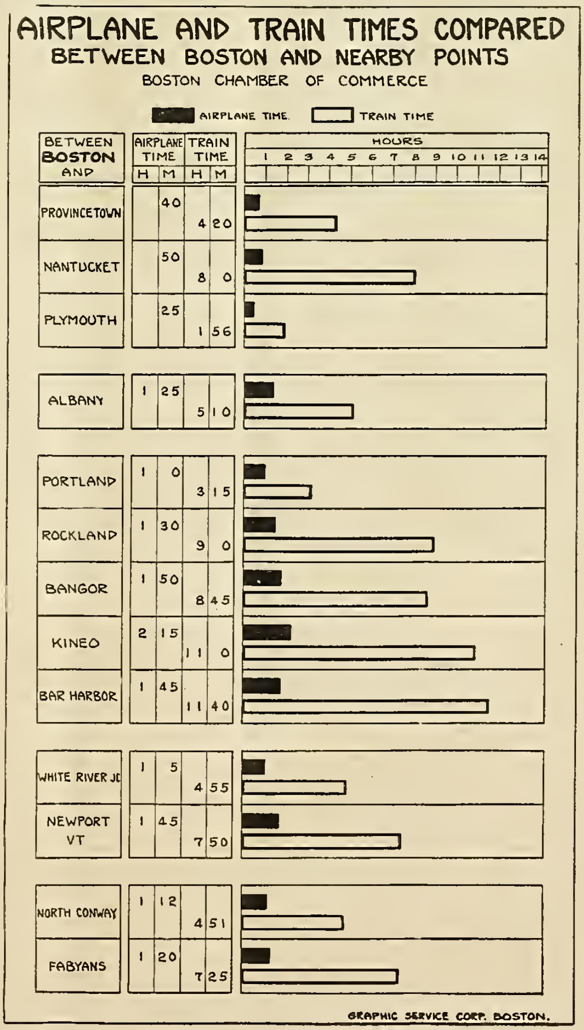
Boston has an airport already under construction. It is expected to be completed by July 1. It is located at Jeffries Point, East Boston. Several other sections of New England also have airports, namely, Hartford, Conn.; Burlington, Vt.; Brunswick, Maine; and Springfield, Vt. The Chamber will cooperate with those in charge of these airports.

"Airways, or aerial highways, are as essential to the development of aviation for commercial purposes as are airplanes and trained pilots," declares the Chamber's committee in a report it has just issued. "The public will not trust itself or its property to any means of transportation until it is assured that the 'roadbed' and terminals are as safe and adequate as the equipment and personnel.

"We already have, and are further developing, airplanes that are safe, economical and practical. Skilled pilots and ground personnel are also available, but with the one exception of the air mail route from New York to San Francisco, there are no adequate airways in the United States. Accordingly almost no use is being made of the wonderful opportunities of the airplane as a means of rapid commercial transport.

"An airway, when fully developed," continues the committee, "is a route between two points, well mapped, and with airdromes and emergency landing fields, so marked as to be readily recognizable from the air, at relatively frequent intervals. This interval should be such as will permit an airplane flying at a reasonable altitude along the airway to be at all times within gliding distance of a safe landing place in case it is forced down by engine trouble. It should average around fifteen or twenty miles. Of course, as night flying develops, it will be necessary along the airways used for such flying to provide beacons at the emergency fields that will operate for long periods without attention, and adequate lighting at the airdromes.

"In general, the uses to which airways will be put may be classified



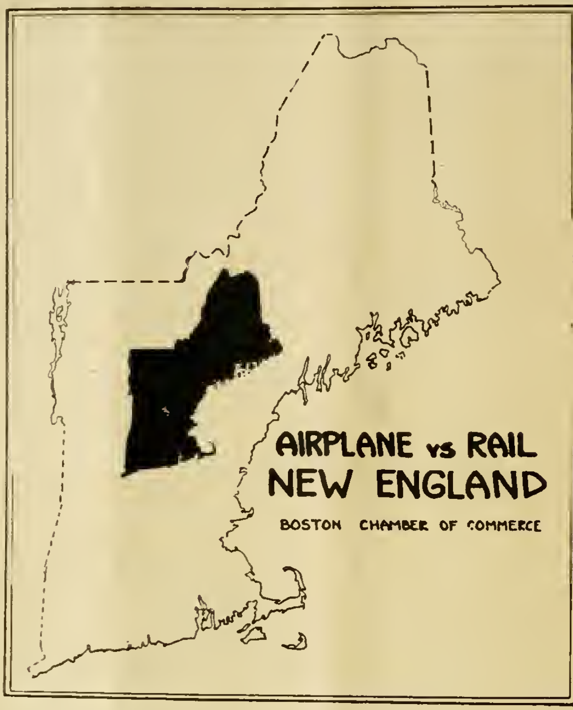
under three heads: (1) the strictly commercial, having as an object the saving in time in transport; and including the air mail; (2) the military; (3) other civilian flying, including that by individuals owning their own machines, and that by commercial operators taking people over territory where new or more beautiful scenery can be obtained from the air which cannot be obtained from the ground. Practically all airways will be used for the third type of flying.

"As a general thing, commercial aviation is not as likely to develop on a route where there is excellent limited train service, or an overnight train service as it is on routes where the distance precludes an overnight train service, or where the service is slow and connections poor. The military airways are such as will be of importance in connection with the defence of the country, and may or may not coincide with the commercial routes.

"A typical airway that should be of value commercially is that from Boston to Albany. At present, a man who desires to take the Twentieth Century Limited to Chicago must leave Boston at 12:30 p. m. in order to catch it at Albany. He spends five hours and ten minutes on the train, and covers 201 miles of track. If an airplane route were established, the distance would be cut to the actual air line distance—142 miles—and the time, because of the saving in distance and the increased speed, would be cut to approximately one hour and twenty-five minutes. The trip to Albany would be pleasanter, and it would not be necessary to leave Boston until practically the close of the business day.

"Similarly to Bangor. The train trip is nearly nine hours and not particularly pleasant. The airplane cuts the distance from 250 miles to 184 miles, and the time is only one hour and fifty minutes. Either of these routes should be of great value commercially.

"While the route between Boston and New York might seem at first glance to be the best proposition commercially, it is doubtful whether it will be of as great commercial importance at first, because of the excellent train service by night, and the limited trains. It is however, of vital importance in the aerial defence of the country. It is also essential if Boston is to have an extension of the air mail—unless a separate line from here to the west is established—and it is necessary if Boston is to be connected with Southern points by air.



Map Showing Relative Size in Hours of New England to a Traveler by Air and to a Traveler by Rail.

"Of use in the tourist business, which would come under the third classification, would be routes to New Hampshire, Vermont, and Maine summer resorts. These would not be of particular value commercially, in the sense that the route to Albany is of value, nor would they be essential to the military needs of New England. But because they would offer a new and pleasant means of travel, and would provide a view of the New England mountains and lakes that could not be obtained even by the sturdiest mountain climbers, such routes should prove of distinct interest to the visitor to these resorts.

"It is our opinion that the development of New England airways will tend to draw New England communities closer together and make of them a more compact unit. When it is possible for a business man to go from Boston to central Maine or northern Vermont in two hours, or to Providence in twenty minutes, or to western Massachusetts in a little over an hour, the tendency will be for him to take a greater interest in the development of New England as a whole."

The New All Metal Monoplane

The first all-metal airplane designed by the Engineering Division, Air Service, and manufactured by the Gallaudet Aircraft Corporation, was recently delivered to McCook Field and given its maiden flight. The model is a Corps Observation, its official designation being "CO-1".

Both the wings and fuselage are covered with corrugated duralumin, and the structure proper is heat-treated steel and duralumin. The weight of the airplane empty is 3,000 pounds; fully loaded it is 4,750 pounds. Unlike most metal-covered airplanes, the CO-1 is not over weight. It could safely carry loads greatly in excess of the specified design load, which is 1,750 pounds. It is powered by the standard Liberty 12 engine, and has a gasoline capacity of 125 gallons.

There are several unusual features embodied in the design. The primary function of this airplane being ground observation, the wing is placed at the top of the fuselage and its thickness reduced adjacent to the cockpit to give the pilot an unobstructed view of the ground. The wing tapers to its full thickness at a point four feet from the fuselage and is braced thereto by external steel struts. Glass windshields are provided at the sides of the pilot's cockpit, making the use of goggles unnecessary.

Universal Propellers May Mean New Speed And Distance Records

IT MAY be of interest to speculate on what might again be done with the Army's Fokker if it becomes necessary to break the world speed records over again for 2500, 3000, 3500 and 4000 kilometers and the distance.

DISTANCE RECORD

It is assumed that the propeller used on the Fokker was of low pitch and that it turned at maximum rpm in getting off the ground with its great load of 739 gallons of fuel and 35 gallons of oil, using the 375 h. p. Liberty, with low compression pistons. As fuel is burned it is obvious that the rpm's would increase owing to the lessened head resistance due to the lightening load, making it necessary to throttle the engine to prevent its running above normal speed.

Distance is what we are after, say. This means running the plane at most efficient angles and the engine at most efficient consumption speed.

Now, using a Universal Propeller, the maximum load of fuel and oil could be taken off the ground, and climb to the desired altitude would be made quickly with the pitch at an efficient low angle, which would be a matter of predetermined knowledge and indicated on the dash.

Then the plane would be leveled out and with the consumption of fuel the pitch would be increased degree by degree, as shown on the dial, keeping the engine at its most efficient running speed. It is estimated that in the making of a distance record a Universal Propeller might be expected to furnish from 20 to 25 per cent. additional mileage.

The analogy might be something like this. We go out and make a distance and speed record with the flivver running in second speed. Now we go out and run the car over the same course in third speed and for the same engine rpm's we get a greater total mileage and a higher car speed throughout the trip.

However, the airplane with the Universal Propeller has a bit the advantage—it has an infinity of speeds, forward and reverse. But the reverse is the subject for another story.

RECORDS CARRYING USEFUL LOADS

The International Federation has now its new classification of records made carrying useful loads, in duration, distance, altitude. We can take out the Army Fokker, make some new world records, and then just as soon as the records are beaten, put on the universal prop—provided the enemy contestant doesn't do the same—and take the same old "ship" out and beat them all over again.

HIGH SPEED SHORT DISTANCES

Even in a straightaway, some additional speed is possible. Coming down in a dive, preparatory to straightening out for the course proper, with the universal propeller advantage can be taken of the power of the engine in addition to the power of gravity, to increase the speed. Instead of depending on the power of gravity alone as must be the case in using an ordinary propeller. This arises from the fact that the diving plane has a speed in excess of any possible pitch speed of the propeller unless turned at a speed above the highest speed at which the engine is capable of giving power.

SPEED RECORDS

A prop can be designed for only one thing at a time—high speed weight lifting, or lower engine speed for a given airplane speed. If a prop must be used which will take a great load off the ground it certainly won't help any in making speed. If speed records are to be made over long distances at the same time, say, as a distance record is also being made, roughly half the journey at the start will be at comparatively slow flying speed and the prop must turn at high rpm to carry the load. The other half of the journey must be made with engine throttled so as not to race, thus reducing its power and cutting down the proper flying speed of the plane.

Here, the Universal Propeller permits the gradual increasing of pitch and airplane speed as the full load diminishes while the engine is running along at its proper rpm.

It may be conjectured that, perhaps, an increase in airplane speed could be made gradually up to 25 or even 30 per cent. above the initial speed at the last stage of a journey, of say, 4000 or 4500 kilometers.

Airplane Sky-Rocket Not So Good

Takes Five Times the Fuel for Same Flying Speed --Jet Propulsion Does Not Compete Yet With the Old Time Screw -- But There Are Possibilities

AT THE highest flying speeds yet attained, jet propulsion requires about five times as much fuel as ordinary screw propulsion. The relative fuel consumption and weight of machinery for the jet, however, decrease as the flying speed increases, but at 250 miles an hour the jet would still take about four times as much fuel per thrust horsepower-hour as the air screw, and the power plant would be heavier and much more complicated.

If Lee Burridge were alive today he would be much interested in these conclusions developed by the Bureau of Standards. The turning of an airplane into an animated rocket was a pet idea with Burridge.

Now, at the request of McCook Field, which is interested in jet propulsion and helicopters and other ideas aimed at the home designing of machines which can outdistance the world and generally at the putting of America "first in the air," the Bureau considered the plan of issuing from a nozzle a continuous stream of combustion products, making of the airplane, in fact, a pseudo winged rocket. The air needed for the jet was to be taken in by a power-driven compressor and delivered at increased pressure to a receiver acting as a combustion chamber. The liquid fuel was to be sprayed into the combustion chamber and burned there continuously at constant pressure, so as to increase the temperature and volume of the gaseous mixture. The resulting combustion products, consisting mainly of nitrogen, steam and carbon dioxide, were then to expand freely through a suitable nozzle from the receiver pressure to the outside atmospheric pressure at which the air was taken in by the compressor.

"For the present we shall consider only a simple nozzle such as used in steam turbines, and we shall not discuss in detail the possibility of improving the propulsive efficiency of the jet by any of the 'aspirator' or 'ejector' devices which have been proposed for increasing the momentum and thrust. If such devices are found to be effective, the prospect for jet propulsion will be correspondingly improved; but we wish first to inquire what might be done without them and from what point improvements must start."

The power needed to compress the air for the jet was found to be greater than that required for the same thrust power from an air screw of 70 per cent. efficiency, until the flying speed is about 250 m. p. h.

However it is considered the engine might be run faster than is now customary and thus reduce the weight per b. h. p. over that of the air-screw engine. But the air cylinders would add weight again and it is estimated that, at best, the combined engine-compressor unit would be at least 50 per cent. heavier than an ordinary aeronautic engine of the same power. This observation does not include the weight of combustion chamber, nozzle and fuel injection system, which, it is estimated, would more than offset the weight of the screw propeller.

The "large, awkward and fragile" propeller would be eliminated, "and only the nozzle and not the engine would have to be located with regard to the axis of thrust. Thus the design would be more flexible. The machine might....be given brilliant maneuvering powers by utilizing the powerful steering effect of swinging the nozzle."

Yet, there still seems to be another drawback. "A machine which had to start—if it could get off the ground at all—by emitting a jet of flame at 2500 degrees F. and at a speed of one mile a second would hardly be a welcome visitor at flying fields."

Last, but not least, Mr. Edgar Buckingham, of the Bureau of Standards, author of the report which is being published by the N. A. C. A., says there does not appear to be, at present, any prospect whatever that jet propulsion of the sort here considered will ever be of practical value, even for military purposes.

Millions Involved in Two Grant Patent Suits

RUDOLPH R. GRANT comes into court through Vernon M. Dorsey, Trustee, who alleges that the Army and Navy have used one of his patents without right of license, although notified of infringement, and he asks that Uncle Sam pay him the sum of $200 for each and every airplane made for him since July 1, 1918, which is alleged to have infringed his patent.

This patent is No. 1,263,757, granted April 23, 1918, on which application was filed February 6, 1912. The principle claim of interest at the moment is that covering the wing curve employing the Cissoid of Diocles. It is claimed by the Grant interests that in the DH4s was used the RAF-15 wing which is said to use the cissoid of Diocles. Some 3227 of these had been completed up to Armistice Day alone.

Grant was the inventor of an "aerostable" machine with which a novice, M. H. Simmons, began flying in 1911, never having been in an airplane before. In this machine was incorporated the cissoid of Diocles wing curve, it is said, and other principles of inherent stabiliy resulting from experiments begun two years before.

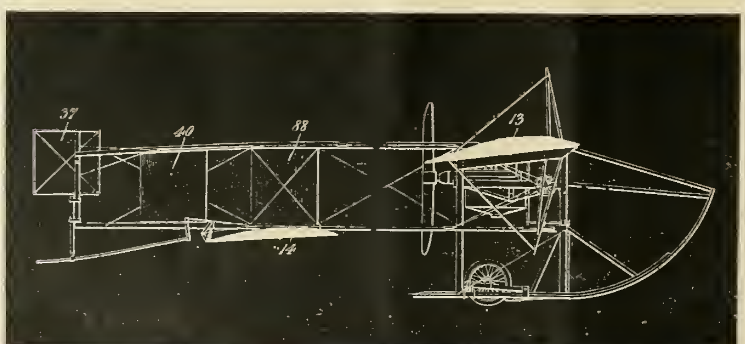
The claims sued upon in the curve patent are abstracted as follows:

A supporting surface for a flying machine having a fore and aft curvature, the curvature being a cissoid of Diocles, the vertex of which forms the entering edge; a member adapted to react with an aero-form fluid having its curvature that of the cissoid, etc.

The claims in all number 17.

SECOND SUIT

In the second suit, brought by R. R. Grant himself, as plaintiff, the claims are on the grounds of longitudinal stability. Grant admits to being the discoverer of the laws of longitudinal stability. He claims $200 for each airplane, of every kind and description, made by or for the Government since July 1, 1918. The number will be that representing the major portion of those made during the war, totalling, it has been alleged, in the neighborhood of 15,000. From records, during 1918 and 1919 some 12,325 airplanes were built for the Army and 2966 for the Navy, not to mention those delivered thereafter on uncompleted contracts. Here is a tidy little nest egg of $3,000,000 or more, it would seem.

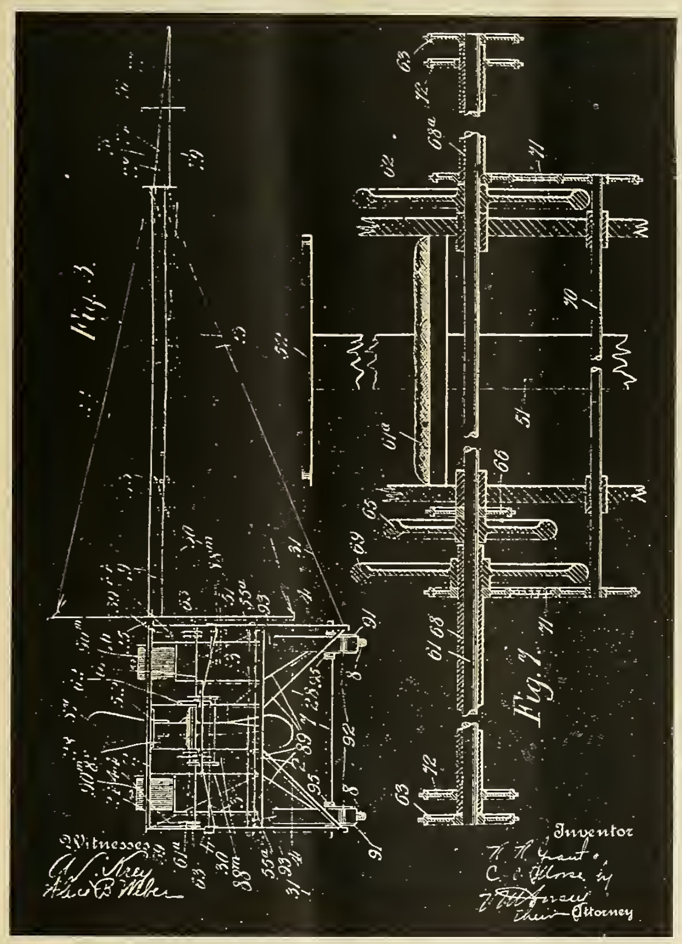


Side view of the Grant Machine

The Grant suit may not immediately appear of so great interest. He makes no charges of conspiracy nor of attempts against his life, liberty and pursuit of happiness, if such is possible in aeronautics. He was not involved in any contracts during the war, nor since, so far as one has been able to discover without research, and has generally kept himself rather quietly in the background.

However, his knowledge and experience in the field of aviation was not lost to the country in the late war, as we find him one of the first to offer his services in this particular field. He served as an Assistant Engineer in the Inspection and Production Departments from April 1917 until May 1919, at which latter date he returned to commercial life. His work for the Government during the war period was largely reproduction work, he not being assigned to any work involving the questions of design.

Grant states in this case, also, that



Details of the Grant system of control

the Army and Navy made use of his invention and discovery without right or license, although notified of infringement of his patent 1,195,207, granted Aug. 22, 1916, on which application was filed Oct. 27, 1913.

The claims on which reliance is being placed may be abstracted as follows:

An airplane in which at speed of normal horizontal flight the center of gravity is in front of the center of lifting effort and is in the rear thereof at excessive speeds above the same; an airplane in which the c. g. and c. of drift pressure are maintained coincident under varying conditions of flight, and a propeller located substantially at such co-incident point.

In all there are 9 claims respecting the same principle of design.

The object of the Grant invention in longitudinal stability is to provide an airplane having the centers and the direction of the application, of its forces, reaction and masses so positioned with respect to each other as to insure inherent stability. For this purpose the machine, which was built and flown in 1911 and 1912 both as a land and as a water machine, was so designed that its center of gravity and its center of drift pressure, or head resistance, as well as the center of application of the propulsive power, were practically coincident. At normal speed of horizontal flight the c. g. is slightly in advance of the center of lift. With the increase of speed the center of lift will shift forward. The center of lift and the center of gravity are both designed to be located in the line of thrust.

By this construction upon turning the machine upon its c. g. without substantially displacing the center of the propeller, and with only an angular change in the position thereof, the propeller does not by its thrust resist or aid such change or swing of the machine, the only action of the propeller being that of a gyroscope tending to prevent change in the angular position of the axis of the machine.

By this location of the center of pressure with respect to the c. g. at normal speed of horizontal flight, the elevators are normally called upon to slightly lift the head of the machine. A slowing down of the machine effects such change in the location of the c. p. with respect to the c. g. that the machine drops slightly by the head and starts to glide, with its attendant increase of drift speed, whereupon the c. p. again moves forward and tends to head the machine up, this being repeated in case of engine stoppage and as often as may be necessary to effect a safe landing by a series of glides or recoveries.

Variation was also possible in the angle of incidence by the aviator and an arrangement was provided whereby the relative position of the fore and aft supporting surfaces could be varied coincident with the change in the angle of incidence in order to maintain the center of lifting effort constant with respect to the c. g.

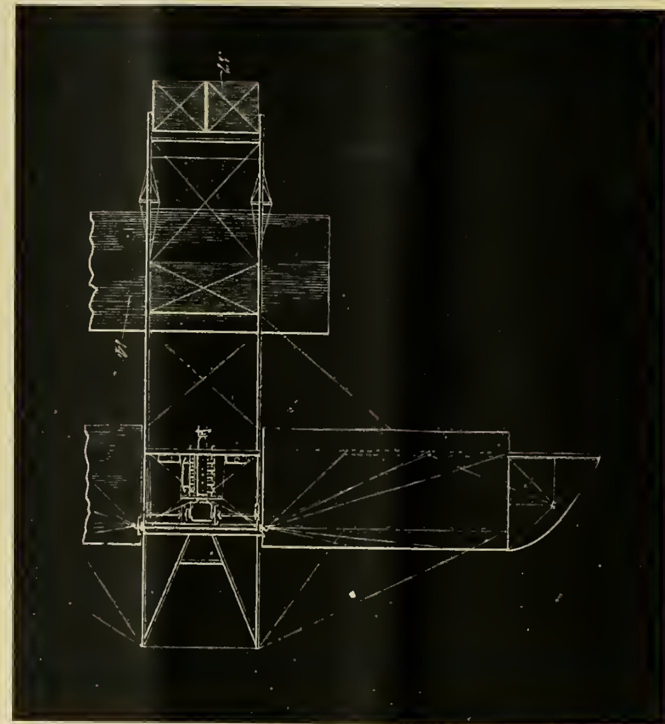
The Grant system is especially applicable to monoplanes and to machines in which the desired vertical position of the center of pressure is obtained by placing the rear plane behind and below the forward surfaces.

The design of the machine is, further, such that the c. of p. remains substantially in the line of thrust and does not vary vertically with respect to the c. g., in spite of its forward and back movement with respect thereto at different speeds.

In Fig. 1. is shown a sketch of the Grant machine as built and flown by a novice.

On each side of the fuselage are forward pivoted wings 13 and underneath at the rear, another pivoted supporting surface 14 the latter being below the front surface and having its center of pressure below the line of thrust, and being at a less angle of incidence than the front planes, while the front planes have their center of pressure above and on the upper side of the line of thrust. The propeller is mounted in the line of thrust, the center of the propeller being substantially at or slightly in the rear of the center of gravity, the center of the propeller being as close thereto as the limitation will admit. Elevator 37, rudder 40 and vertical stabilizer 88 are provided.

The front planes 13 are pivoted along the forward main spar to the fuselage and are movable on such pivots to change their angle of incidence. The mechanism for this purpose comprises travelers sliding longitudinally in the fuselage of the machine, there being one traveler on each side of the machine connected to the corresponding front surface. The rear plane 14 is also pivoted to the fuselage and is moved upon such pivot by means of connecting wires, one wire being connected to each traveler and to the corresponding side of the rear plane, the inclination of the rear plane being less than that of the front plane. The curvature of the front and rear planes is that of the cissoid of Diocles. In such a construction, the machine can be slowed down by increasing the angle of incidence of the several planes, but due to the character of the curve of the planes this is accompanied by a rearward shifting of the center of lifting effort on each of the planes, and therefore, unless means be provided to prevent it, by a rearward shifting of the combined center of lifting effort in respect to the center of gravity and a consequent disturbance of the balancing conditions of the machine. To prevent this the invention contemplates a bodily movement of the rear plane upon the fuselage upon a change of angle of incidence, whereby it will be moved forwardly upon an increase of the angle of incidence of the several planes and will be moved rearwardly upon a decrease of the angle of incidence of such planes, and whereby the conjoint center of pressure of the several planes under varying conditions of angles of incidence will be maintained substantially constant in respect to the center of gravity. To effect this longitudinal movement of the rear plane upon a change of angle of incidence the rear plane is pivoted in blocks sliding on bars depending from the lower members of the fuselage. The rear end of the rear supporting plane is adapted to be angularly adjusted by means of links pivoted to the fuselage and to the plane and having connected thereto, intermediate of their ends, connecting wires, one end of which wires may be led through a slide bar, the other end of such wires being passed over pulleys to the rear of the supporting plane and returned through leaders and passed over pulleys in front of the travelers to which the other end of the wire is connected. The link contains a series of perforations whereby the desired angle of incidence may be obtained according to the several conditions which may arise.



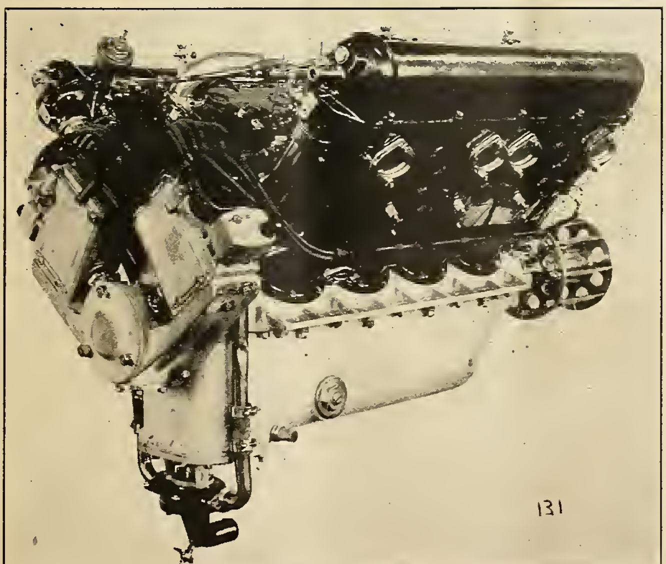
Plan view of the Grant machine

The Story of an Endurance Test of a Remarkably Reliable Engine

DURING the past year Lieutenant B. G. Leighton, of the Bureau of Aeronautics, Navy Department, has been working steadily to bring about improvements in engines, in order to provide greater durability and reliability. During the war, duration tests were conducted over periods of fifty hours of running. It was a mark of distinction to pass such a test successfully, although the engines were not run at full throttle, the run was broken into five separate periods of ten hours each, and all ordinary adjustments and replacements of minor parts were permitted. Improvements made to post-war types convinced Lieutenant Leighton that a longer period of test than fifty hours was required to measure the life of new engine types. Accordingly, specifications were drawn for an endurance test of 300 hours, although the engines were only required to develop about six-tenths of their rated horse power. As certain types of engines successfully met this test, new specifications were arranged, requiring engines to operate at full rated horse power and to use standard aviation gasoline.

Some time ago, a Wright E-2 engine was submitted to this latter test. The test was conducted at Anacostia, under the direct supervision of the Bureau of Aeronautics. It was found that the E-2 performed very well up to 125 hours, but at the conclusion of that period of running, the valves, and valve seats particularly, and the pistons were in bad condition, requiring replacement before continuing the test. In connection with the life of the E-2 engine at full throttle, it is interesting to note a statement recently given out by Lieutenant Leighton in a paper read before the Washington Section of the Society of Automotive Engineers. The fact is brought out in this paper that the Liberty engine, which is a war development, and by many still considered to be the standard of durability, has an average life of 72 hours between overhauls in actual Navy service, while the Wright E-2 engine has an average life in actual service of 101 hours between overhauls, and under substantially the same service conditions. It is, therefore, apparent that, while the E-2 was not capable of successfully meeting Lieutenant Leighton's full throttle endurance test, it, nevertheless, showed remarkable improvement over war time standards of reliability.

Meanwhile, the Wright Aeronautical Corporation was developing a new type of cylinder design. This design was first worked out on their twelve cylinder 600 h. p. type, known as "T-2", and incorporated in that type. With Lieutenant Leighton's permission, it was determined to construct a pair of cylinder blocks of this new type, and again make an effort to meet successfully the Navy's full throttle endurance test. This type engine, which is in current production, is known as type E-4 and is the very latest Wright development in the 200 h. p. size. In order to measure the length of life of certain of the major parts of the engine, the new type of E-4 cylinder blocks were mounted upon the same engine which had previously run 250 hours of full throttle on the E-2 test. No changes were made in the engine, except the replacement of the E-2 cylinder blocks with the E-4 type. This E-4 engine has just completed a successful 300-hour full throttle test. Certain press dispatches in connection with the completion of this test erroneously stated that the E-4 engine had been operated continuously for a period in excess of 500 hours. As a matter of fact, not even the last 300 hours of running were continuous. No involuntary stops were made during this latter period, but several voluntary stops were made, principally to change clubs, as the engine was operated on a torque stand with the clubs exposed to the weather. Moreover, the early part of this test incorporated certain tests of lubricating oils, and one or two stops were made for the purpose of changing oils. However, the engine did operate throughout the 300-hour period without failure of any part, either major or minor, and the valves and pistons were in almost perfect condition at the conclusion. In fact, the engine was pulling a trifle more horse power at the conclusion than at the beginning of the test. Throughout the run it averaged approximately 205 h. p.


The Wright Engine

Disassembly of the engine, and inspection disclosed the fact that a ball bearing retainer ring had broken away, and, very probably due to this, one of the crankcase studs was broken. Neither of these damaged parts, however, interfered with the running of the engine or with its ability to develop its maximum power at the finish.

In the past the limiting features of long durability at full throttle have been, primarily, valves, pistons and connecting rod bearings. In the E-4 type of cylinder construction, it seems that the Wright Company have set up an entirely new standard for these parts. The Wright engineers believe that much of this success is due to the new silchrome tulip valves and the new type of bronze valve seats, and in the case of bearings to the use of Kelmet.

Of utmost interest to service possibilities of the E-4 engine is its comparison to its predecessor, the E-2. Under full throttle endurance test, the life of the E-2 was apparently 125 hours, as against 300 hours or more for the E-4 under the same conditions. It is a fact that in actual service the E-2 may be operated for at least 100 hours between overhauls, which, of course, indicates a much better service life for the E-4. The superiority of these improvements for the training plane engine or for commercial projects, as compared with other types, is obvious, as it seems reasonable to believe that the life of the basic parts of the E-4 is likely to be more than that of the plane in which it is mounted.

Wright engineers believe that the results of this test indicate very conclusively that the operating life of the E-4 engine, between overhauls, may be expected to be at least six times the life which in the past has been realized with service types of engines.

Cotton Transported by Airplane

FOR the first time in history cotton has been transported through air from the fields where it is grown to the mills where it is made into cloth.

This interesting event was recently made possible through the co-operation of the Army Air Service, the Board of Commerce of Augusta, Ga., the Wamsutta Mills of New Bedford and the Aeronautical Chamber of Commerce of America. Two giant Martin Bombing Airplanes left Augusta at 4:45 A. M. June 4th with two bales of cotton consigned to the Wamsutta Mills at New Bedford. They arrived at New Bedford at 4:39 P. M. actual flying time for 1000 miles being ten hours and fifteen minutes.

Immediately the raw cotton was rushed to the Wamsutta Mills where it was prepared for weaving on the looms. Next morning the two planes took off from New Bedford at 5:45 A. M. arriving in Wash. at noon.

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Photo taken just after the landing of a Martin Bomber at Bolling Field, A. C. Left to right: Lieut. T. J. Koenig, A. S.; Mr. H. Carl French of the Wamsutta Mills, Shriner Bratton, Lieut. Wm. H. Bleakley, pilot of plane; Lieut. H. H. George; General Wm. Mitchell, General Mason M. Patrick, Shriner Goodwin; Lieut. C. H. Graybeal.

The occasion for this really historic flight was brought about by the Shrine Convention in Washington. The flyers carried as souvenirs Masonic aprons made by the Wamsutta Mills from Georgia cotton, delivering them in record time.

While waiting at New Bedford, the flyers were entertained at a dinner presided over by Oliver Prescott, President of the Wamsutta Mills. Among those present were: Captain Romeyn B. Hough, 1st Lieut. Harold L. George, 1st Lieut. William B. Bleakley, 2nd Lieut. Carlyle W. Graybeal, Staff Sergt. Linwood P. Hudson, Staff Sergt. Peter Ceccato, Grover C. Loening, First President Aeronautical Chamber of Commerce, Hon. W. H. B. Remington, Mayor of New Bedford, Representative Charles L. Gifford, Lieut. C. B. Anderson, Commander Fort Rodman, H. C. Meserve, Secretary National Association Cotton Manufacturers, A. H. Andrews, Secretary New Bedford Board of Commerce, Ridley Watts, Ridley Watts & Co., Ernest V. Alley, Barrows & Richardson, Oliver Prescott, President Wamsutta Mills, W. R. West, Director Wamsutta Mills, O. S. Cook, Director Wamsutta Mills, C. F. Broughton, Treasurer Wamsutta Mills, G. E. Rycroft, Assistant Treasurer Wamsutta Mills, A. L. Emery, Agent Wamsutta Mills, W. F. Staples, Wamsutta Mills, H. C. French, Purchasing Agent Wamsutta Mills.

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Loading the cotton on board a Martin Bomber at Augusta, Ga.

Several addresses were made by men prominent in aviation and the cotton industry. Grover C. Loening, First President of the Aeronautical Chamber of Commerce, under whose auspices the flight was sponsored, made a plea for a Congressional regulation of flying in order that the air may be cleared of unlicensed and freak airmen so that development may be carried on by sane experimentation.

Charles F. Broughton, treasurer of the Wamsutta Mills, said: "I believe that the day will come when by air or some other means rapid shipment of cotton will be possible. Rapid shipment will mean added production which of course will mean lower costs. I think that the flight of to-day, which was completed within 17 minutes of the scheduled time, is an indication of

(Continued on page 346)

New N. A. C. A. Air Speed Meter

A NEW type of recording air speed meter has been designed by the technical staff of the National Advisory Committee for Aeronautics for the purpose of recording the air speed in flight and for studying the flow in wind tunnels. By changing the diaphragm it is possible to use it for studying a large number of aeronautic and automotive problems. For example, it could be used to study the pulsations of flow in an intake or exhaust manifold or the character of sound emitted by various types of mufflers or the sound waves from a rotating air screw. For the latter uses this instrument has the advantage over a number of laboratory instruments designed for recording sound waves, in that it is portable and can be used under conditions of considerable vibration without having its readings affected.

Air speed in flight has been recorded almost exclusively in France and in this country by the Toussaint-Lepère air speed meter which consists of a recording pen operated by a spring loaded bellows. For very accurate work this instrument has a considerable amount of friction and its natural frequency is so low that it can not be used to record rapid changes in air speed, such as bumps in flight or pulsations in the wind tunnel. The British have constructed a successful recording air speed meter in combination with their Mark II accelerometer which is of a higher frequency and has less friction than the Toussaint-Lepère instrument.

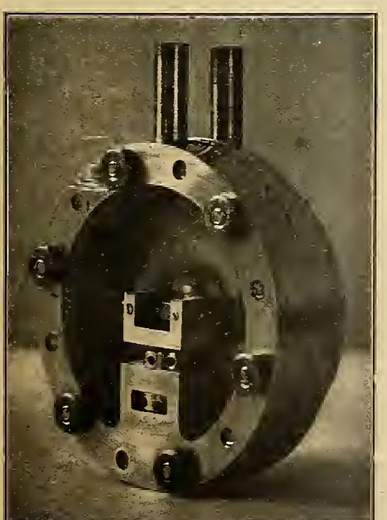

Fig. 1. Capsole and diaphragm

The N. A. C. A. instrument (Fig. 3) was designed with the idea of producing an instrument for recording the absolute air speed in flight with great accuracy and at the same time to have such a high natural frequency that it could be used to study the structure of rapidly changing air flow. As this instrument is of general usefulness in recording pressure difference it is thought that a complete description would be of interest.

*See *Aerial Age* for December, 1922, Page 585-586.

Diaphragm Capsule

The pressure difference to be measured is transmitted to either side of a steel diaphragm rigidly clamped at the edges between the halves of a circular capsule. As an unstretched diaphragm—due to a trace of concavity which can not be removed—has two points of equilibrium at zero pressure, it was found necessary to warm the diaphragm before clamping in order that it might be normally under a slight tension. It is also essential that the material of the capsule and the diaphragm have the same coefficient of expansion otherwise the sensitivity will change with the temperature. This capsule and diaphragm is shown in Figs. 1 and 2.

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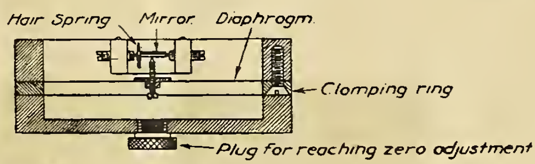


Fig 2. Section of capsule

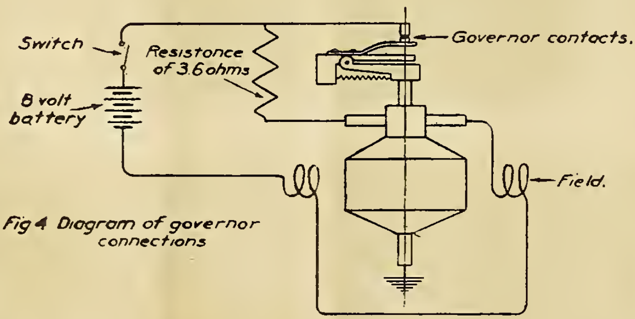


Fig 4 Diagram of governor connections

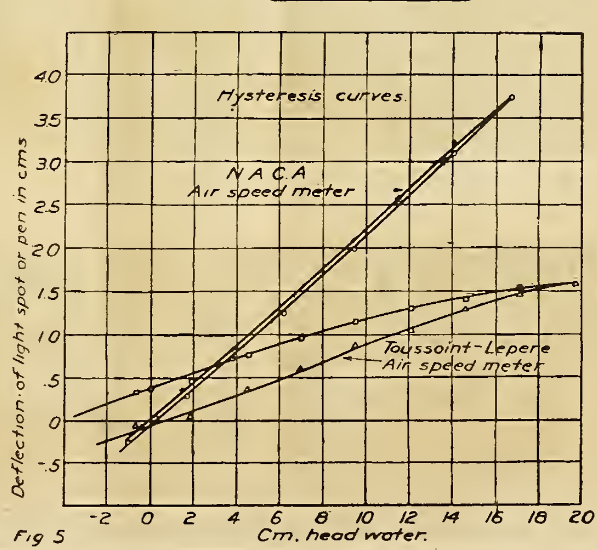


Fig 5

A hardened steel screw passes through the center of the diaphragm and rests against the polished back of the mirror staff. This staff is mounted in a highly polished conical steel socket and is held against the diaphragm screw by a light hair spring. A plane silvered mirror 4 mm. square and .2 mm. in thickness is cemented to the staff. The deflections of the diaphragm are thus converted into a rotary motion of the mirror with very slight friction. The natural frequency of the diaphragm and mirror is about the same as that of a telephone diaphragm—2000 vibrations per second. This frequency could be made even higher than this if it were desired to use the instrument for studying high pitch sound waves.

THE FILM DRUM

The film is contained in interchangeable daylight loading drums revolving once in two minutes.

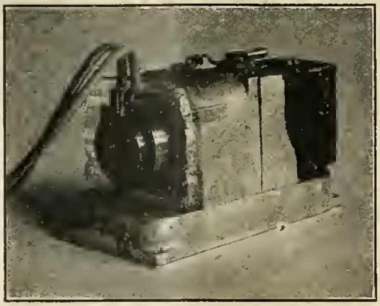


Fig. 3. Recording air speed meter

THE DRIVING MOTOR

The film is moved by an electric motor connected to the drum by a worm drive, and developed, after a considerable amount of experimental work, as the most satisfactory means of driving a drum at a relatively high speed. This motor is of the direct current, series type and is held at constant speed by means of a governor as shown in Fig. 4. This governor will hold the speed to within +2% of constant for considerable changes in voltage and load. The motor runs on 8 volts, normally taking 1.6 amperes and will reach its normal speed in less than one-half second after closing the switch, with a starting current of 4½ amperes.

PRECISION OF THE INSTRUMENT

The width of the line traced by this instrument is rather great, 0.010 of an inch, due to the poor quality of the lens. If readings are taken on one edge of the line the sharpness is sufficient to read within 1/1000 of an inch, which will give a precision of 1% when the deflection is only 1/10 of an inch.

In order to determine the hysteresis of this instrument its readings were compared with those of a water column when the pressure was increased and decreased. The difference between ascending and descending curves was nowhere greater than 2% of the maximum reading, and this would undoubtedly be greatly reduced under the condition of vibration which exists on the airplane. For the sake of comparison a similar run was made on a Toussaint-Lepère air speed meter with the pen resting on the paper in a normal manner. In this case the corresponding hysteresis error was 26% of its maximum reading. The two sets of curves are plotted in Fig. 5.

Several records are shown (Fig. 6) which were taken on a JN4H airplane in flight and it will be noted that even the high period bumps are recorded. In Fig. 7 are shown several records taken by speaking into the back of the capsule with the same diaphragm setting but with the drum revolving at a much higher speed. It will be seen that the sound waves are recorded very sharply even though the instrument was not especially lightened for this type of work.

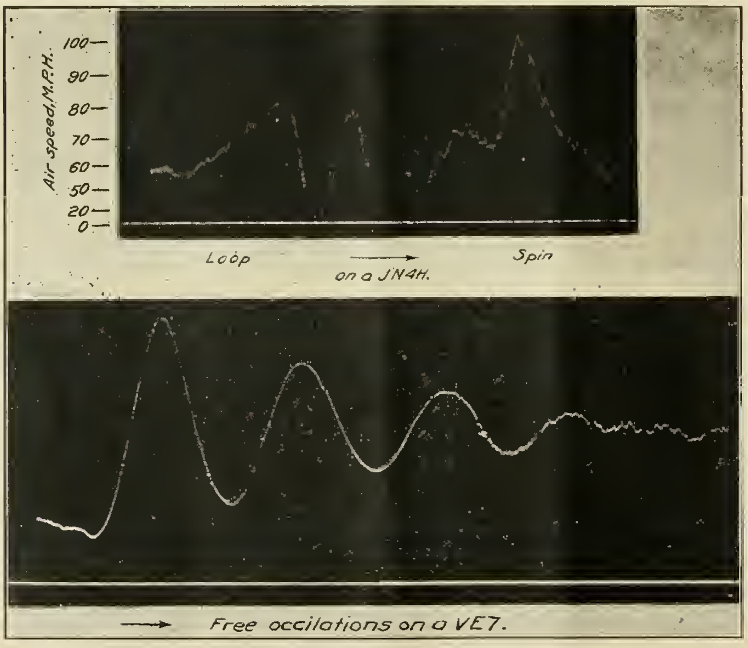


Fig. 6. Some records on full flight. One inch horizontally corresponds to 12 seconds.

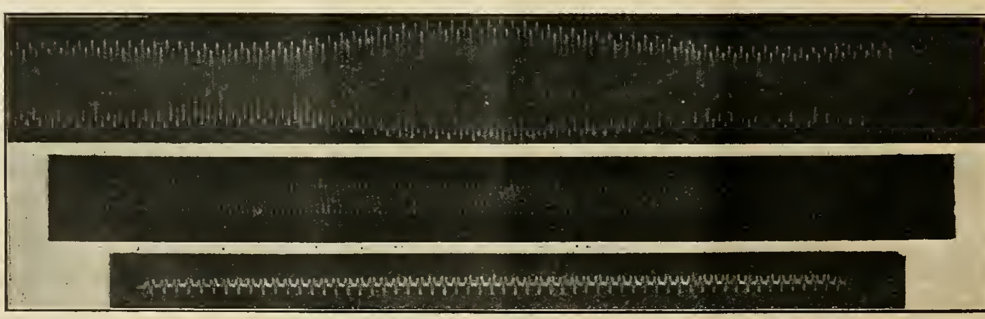


Fig.7. Sound waves produced by the human voice. One inch horizontally corresponds to .048 seconds

Exponential Law of Variation of Drift and Lift of Models of Airplanes and Wings at Various Velocities

By Ing. Colonel G. Costanzi, and Captain Mario Bernasconi of the Italian Army

IT is a well known fact that the resistance to the motion of a body in the air does not really vary with the square of the velocity. This was pointed out first by ourselves many years ago, (see Bulletin of Royal Establishment of Aeronautical Constructions, Rome, October 1912—Experiments on Hydrodynamics, by G. Costanzi), when we established the corresponding laws of variation.

The various peculiar aspects presented by the polar diagrams of models of wings and models of aircraft obtained at different wind speeds are also known.

The object of the present research work has been to find out:

(1) What are the laws of variation of drift and lift of models of airplanes and wings at various velocities.

(2) After these laws have been established, due to the fact that modern wind tunnels do not allow a wind speed anywhere near to the actual speed of aircraft in flight, are we justified in extending to actual flying conditions the laws which apply to wind tunnel experimental work?

(3) What is the difference between the polar diagram derived from the actual performance of an airplane in flight and the polar diagram derived from experiments made on a model in a wind tunnel?

Our investigation has been made on a number of models tested in the aerodynamic laboratory of the Experimental Aeronautic Institute of Rome. This work, however, can be continued in other laboratories and from the comparison of the results thus obtained the necessity of systematic experimental wind tunnel work in aerodynamic laboratories will be quite evident.

The results obtained so far on a number of models of wings and aircraft seem to be sufficiently interesting to be worth being brought to the attention of aerodynamic research workers. This work is going to be continued and completed. In the meantime, we will give a resumé of the work done and the results of experiments made on a model of triplane that we will call Co. Ma. (see figure 1.)

This model was very accurately made in aluminum, 1/50, size, so as to allow being successively tested in various aerodynamic laboratories. The upper wing of this model is the same as the R. B. 25, described in Technical Bulletin, No. 18, issued by the Italian Direction of Experimental Aviation. The central wing is the same as the R. A. 19, described in Technical Bulletin No. 2, and the lower wing is the same as Section E. F., of the wing R. B. 22, Fokker, described in Technical Bulletin No. 13.

The experiments were made at wind speeds of 15, 20, 25, 30, and 35, m/sec. Angles of incidence, between 0° and 20°, and between 0° and 12°. Negative angle is the angle of incidence with the model upside down. The 0° is referred to an imaginery line on the fusilage placed in a plane parallel to the three planes upon which the three wings would naturally rest, (bitangential planes to the lower ends of the wings).

In table No. 1, are given the results of the experiments made and in Fig. 2,3,4, and 5, are plotted the values of Rx and Ry. In these diagrams logarithms of velocities in meters per second were taken as abscissas and the logarithms of corresponding forces expressed in grammes were taken as ordinates.

The conclusions to be derived from these experiments are as follows:

(1) For each value of the angle of incidence the values of lift and drift, Ry and Rx, vary with the velocity according to an exponential law of variation. The exponent of this law however, is not constant and varies with the angle.

(2) While the exponent of the law of variation of Ry is in the order of magnitude of 2, the value of the exponent of the law of variation of Rx is in the order of magnitude of 1.74 for models of aircraft, and varies between 1.5 and 1.6, in the case of experiments made on models of wings.

In table No. 2, are given the values of the exponents of the exponential equations of Rx and Ry given in diagrams 2 to 5.

The values of n given in table 2 are obtained from experimental data. The values of n given in table 3, are obtained by interpolation from experimental data.

In fig. 6, the values of n are plotted against the corresponding values of the angles of incidence and from the resulting two curves shown in the diagram, we can derive the following conclusions:

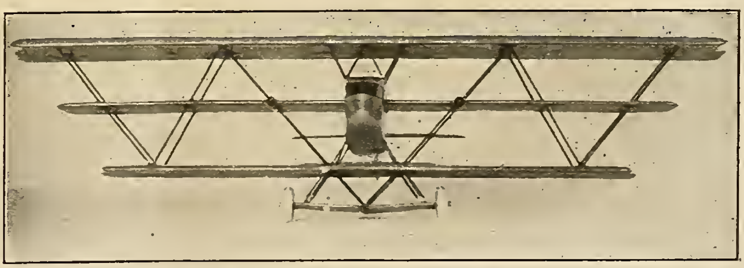
(1) *For any angle of incidence, the vertical component of the total air forces acting on the aircraft model tested, varies almost as the square of the velocity.*

(2) The values of n corresponding to the horizontal component is a minimum for small angles of incidence and increase with the angle, or more accurately stated:

The horizontal component of the total air forces acting on the aircraft model tested increases with the n power of the velocity. The values of n are nearly equal, 1.74 for angles of incidence varying between—5° and +2°, and for larger angles, both positive and negative, they rapidly approach 2. The horizontal component of the air forces acting on a wing model also varies as the n power of the velocity. For small angles the values of n are as small as 1.5, and in the average vary between 1.54 and 1.6. Also in this case, the tendency of n is to rapidly approach the value 2, in the region of either positive or negative angles.

(3) In the region of an angle of incidence of about 4°, (where in the case of the model tested the vertical component is equal to zero) the phenomenon which takes place is not quite well defined and more experiments are needed in order to clarify it.

(4) The foregoing conclusions have been confirmed by all experiments made on other models which we are



Model of Co. Ma. triplane, made of aluminum, span 0.62 meter

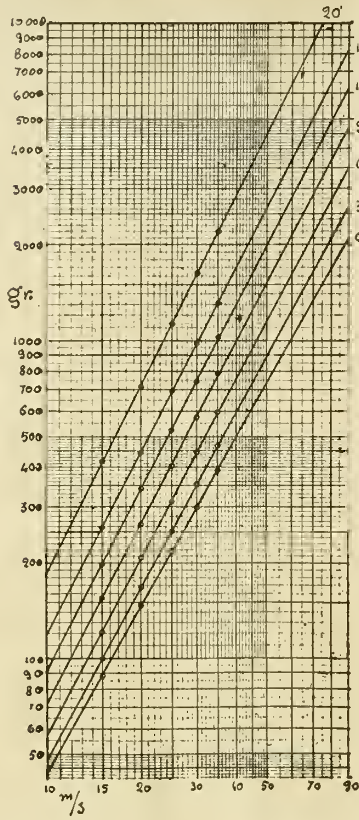


Fig. 2. Values of Rx; Co. Ma. triplane model (Positive angle of incidence)

not at liberty to divulge at the present time. Some slight differences have been noted in other experiments in relation to the minimum values of n and in relation to the limits of variations of n within the region of minimum values.

Considering the fact that the angle of incidence of an aircraft is more or less a theoretical conception, we can be satisfied if experiments on models confirm in a general way the exponential law of variation given in fig. 6. Also considering the fact that in fig. 2,3,4 and 5, the values of Rx and Ry for any corresponding value of the angle of incidence are plotted on straight lines, we feel authorized also in this case to extrapolate.

If we assume that a test has been made at a wind speed of 10 m./sec. (which is the ordinary wind speed used by a number of aerodynamic laboratories) and also a test had been made at 70 m/sec. (which is the actual speed of a number of aircraft), the values of Rx and Ry can be assumed to be those indicated in the diagrams shown in fig. 2 to 5, which are tabulated in table 4.

Let us assume now that an aircraft manufacturer has the values of Rx and Ry either at a velocity of 10 m./sec. or a velocity of 70 m./sec. and let us see what are the conclusions that he might arrive at when using for designing purpose either one or the other set of values.

Let us assume that the model used is the model given in fig. 1. Knowing the values of Rx and Ry at 10 m./sec. and at 70 m./sec. respectively and applying the laws of varion of Rx and Ry given in fig. 2,3,4 and 5, we can find the values of Rx and Ry at a velocity of 1 m./sec. in either case. Applying the law of variation based on a constant value of $n=2$ which is ordinarily assumed to be true, we have the values tabulated in table 5 and we can draw two polar diagrams (see fig. 7), one based on the known values of Rx and Ry at 10 m./sec. and the other based on the values of Rx and Ry at 70 m./sec.

We have thus two polars at 1m./sec., if we take a constant value of $n=2$, while we would have had only one polar if we had applied the law of variation of Rx and Ry that has been revealed by our experiments.

From a cursory examination of the two polars we can see that if either one or the other is used, the anticipated characteristics of the aircraft based on either of the two are quite different. If we assume a total weight of the aircraft of 6500 Kg. and 1200 useful horsepower available (or about 900 H.P. after deducing the losses in the propeller and the transmission) we have:

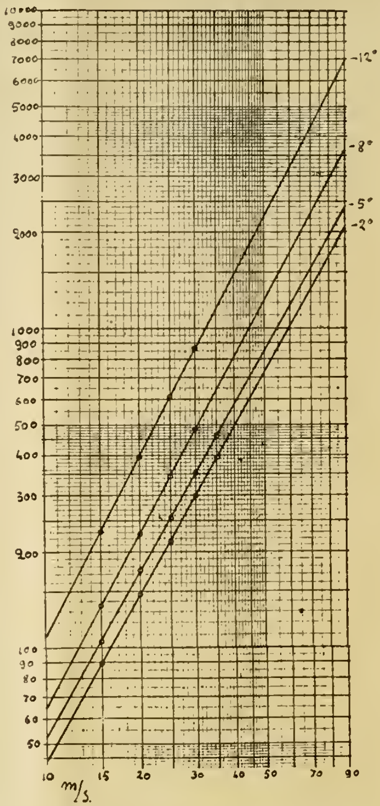


Fig. 3. Values of Rx Co. Ma. triplane model (Negative angle of incidence)

From a Polar Diagram Based on the Data obtained at 10m./sec.

Maximum velocity on the ground	143 Km/hour	
Minimum " " " "	78.5 "	With minimum H. P.
Velocity at 6000 m.	129.5 "	
Ceiling	6,950. Meters	
Velocity at the ceiling	115. Km./hour.	

From Polar Diagram based on Data obtained at 70 m./sec.

Maximum velocity on the ground	163. Km./hour.	
Minimum " " " "	84 "	With minimum H. P.
Velocity at 6000m.	158.5 "	
Ceiling	7,700 Meters	
Velocity at the ceiling	127.55 Km./hour.	

If the aircraft is equipped with a supercharger capable of maintaining constant power up to 6,000 m. altitude, assuming that the power absorbed is 12% of the useful power available, and applying the Eiffel method we have:

	From polar diagram based on data obtained at 10m./sec.	From polar diagram based on data obtained at 70m./sec.
Velocity at 6,000 m., Km./hour	166.	198.
Ceiling	9,900 meters.	10,800 meters.
Velocity at Ceiling Km./hour	137.	153.

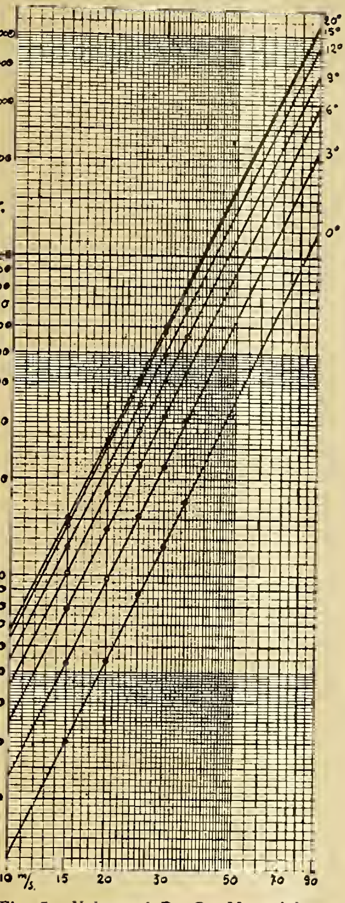


Fig. 5. Values of Ry Co. Ma. triplane model (Positive angle of incidence)

TABLE NO. 1

Angle	V = 15 m/sec.		V = 20 m/sec.		V = 25 m/sec.		V = 30 m/sec.		V = 35 m/sec.	
Io	Rx (gr.)	Ry (gr.)	Rx (gr.)	Ry (gr.)	Rx (gr.)	Ry (gr.)	Rx (gr.)	Ry (gr.)	Rx (gr.)	Ry (gr.)
12°	231	606,7	397	1063,5	608	1685,5	863	2511,5		
8°	133,4	310,1	227,8	560,1	345,2	855,1	484	1266,3		
5°	104,3	79,1	174	131,6	253,8	218,4	352	303,3	416,3	427,4
2°	89,4	148,5	148,6	267,8	215	408,2	299	608,5	394,0	481,8
0°	88,8	301,3	147,1	542,3	217,8	873,1	298	1236,6	388,8	1634,1
3°	100,5	536	167,9	974,5	250,2	1539,3	352	2187,2	467,3	3044,0
6°	121,2	779,9	207,4	1392	310,5	2195,2	445	3160,8	597,0	4344,6
9°	155,1	1013,8	264	1803.8	402,0	2833,9	572,2	4065,4	784,0	5629,8
12°	197	1230,2	342,8	2183,5	524,0	3418,1	748	4937,4	1022,0	6847,8
15°	258,2	1423,5	444,4	2538,6	690,0	3998,8	980,4	5780,1		
20°	415,0	1510,3	718,2	2651,4	1125	4135,3	1629	5880,2		

All velocities are expressed in meters per second and all forces in grams.

TABLE NO. 2 (Values of exponent n)

Angle i°	12°	8°	5°	2°	0°	3°	6°	9°	12°	15°	20°
Rx	1,88	1,83	1,74	1,75	1,75	1,805	1,87	1,89	1,915	1,93	1,985
Ry	2,03	2,01	2,03	1,97	2,04	2,04	2,01	2,00	2,00	2,00	1,99

TABLE NO. 3 (Values of exponent n)

Angle i°	7°	6°	3°	2°	1°	2°	4°
Rx	1,788	1,758	1,74	1,74	1,75	1,763	1,832
Ry	1,99	1,983	2,07	2,03	2,03	2,04	

The discrepancy of the results obtained from the two polar diagrams is quite remarkable and emphasizes the necessity of taking in due consideration the data derived from velocities corresponding to the actual velocities of the aircraft in flight, keeping in mind in the choice of the velocity the principle of mechanical similarity also in relation to the density of the air.

Our experiments have pointed out a method of deriving a polar diagram for any velocity (if the extrapolation of our experimental results is correct) which is more nearly correct than the method heretofore used, which is based on a quadratic law of variation of Rx and Ry. The error involved in the use of our method is certainly smaller than if the other method is used.

It is evident, however, (and this we believe is a very important point), that in order to decide about the merits of a wing section on the basis of a wind tunnel test, the guiding consideration must be the value of the n

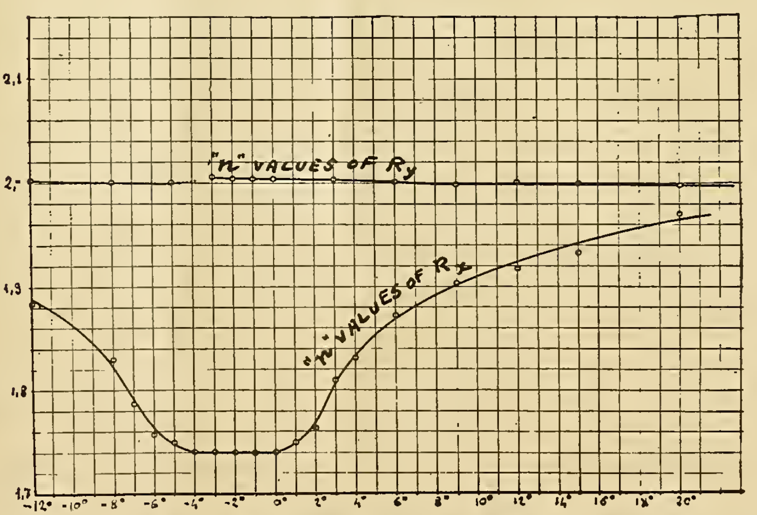


Fig. 6. Values of n for corresponding values of Roc and Ry at various angles of incidence

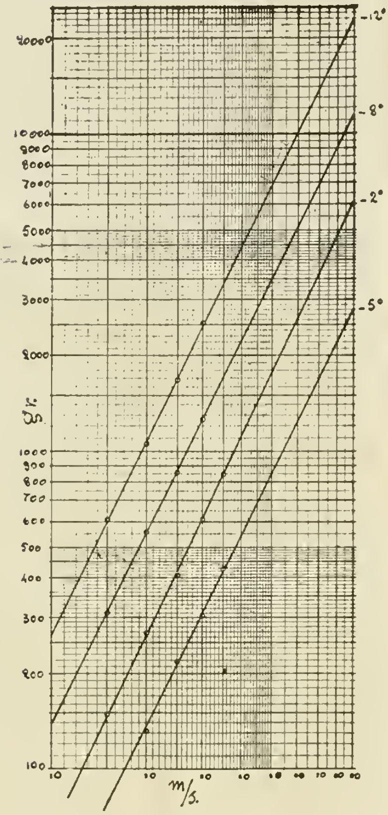


Fig. 5. Values of Ry Co. Ma. triplane model (Negative angles of incidence)

power of the velocity according to which Rx varies rather than the *optimum* efficiency of the wing section tested at one particular air velocity.

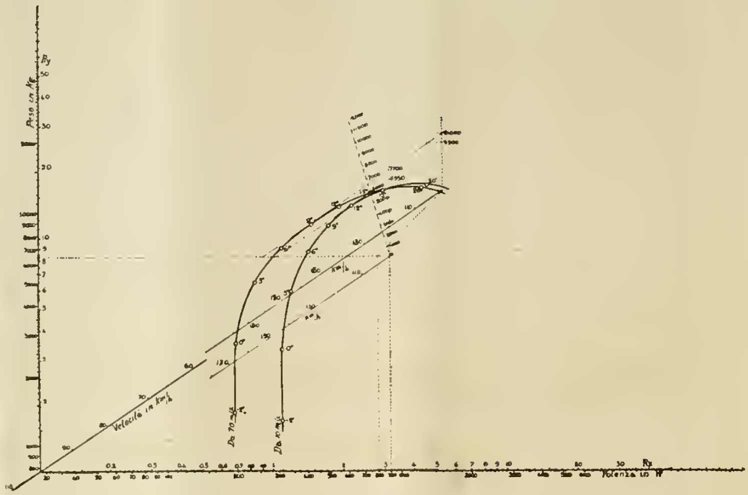


Fig. 7. Polars of Co. Ma. triplane based on experiments at 10 m sec and 70 m. sec respectively

It is possible that a wing section showing a low efficiency at the speed at which it is tested becomes a very efficient wing section at the velocity of flight, due to the variation of the exponential law according to which the air resistance varies at the two velocities.

In another article we will give a method for utilizing the results of our experiments for predicting the performance of aircraft in flight.

EDITOR'S NOTE:

The experiments made by Colonel Costanzi, a veteran in the field of aerodynamic research work, and by Captain Bernasconi point out once more the necessity of adopting a systematic and extensive program of comparative tests in the wind tunnels of all nations and over a large number of models.

Wind tunnel experimental work is done for the only purpose of helping aircraft manufacturers in designing better aircraft. If the cooperation of all aerodynamic laboratories is not secured, wind tunnel experimental work will be a matter of opinion and will never provide the scientific basis of aircraft design that aircraft manufacturers have a right to expect from this sort of research work.

Table No. 5

		12°	8°	5°	2°	0°	3°	6°	9°	12°	15°	20°
Rx in Kg	model scale 1 : 50 at 10 m/s	0,1085	0,065	0,052	0,0441	0,0439	0,048	0,057	0,07	0,088	0,119	0,185
	Full size aircraft at 1 m/s	2,712	1,625	1,3	1,102	1,097	1,2	1,425	1,175	2,2	2,974	4,628
Ry in Kg	model scale 1 : 50 at 10 m/s	0,264	0,138	0,0342	0,064	0,133	0,237	0,3488	0,452	0,550	0,639	0,675
	Full size aircraft at 1 m/s	6,605	3,45	0,854	1,649	3,325	5,927	8,72	11,29	13,75	15,96	16,86
Rx in Kg	model scale 1 : 50 at 70 m/s	4,325	2,3	1,56	1,335	1,330	1,65	2,16	2,895	3,8	5,13	8,60
	Fuli size aircraft at 1 m/s	2,206	1,173	0,796	0,681	0,679	0,842	1,102	1,476	1,939	2,618	4,39
Ry in Kg	model scale 1 : 50 at 70 m/s	13,75	6,95	1,695	3,52	7,15	12,55	17,75	22,2	26,8	30,5	32,1
	Full size aircraft at 1 m/s	7,015	3,545	0,865	1,796	3,55	6,405	9,07	11,326	13,68	15,57	16,39

Table No. 4

		12°	8°	5°	2°	0°	3°	6°	9°	12°	15°	20°
Rx	at 10 m/sec...........	108,5	65	52,0	44,1	43,9	48,0	57,0	70,0	88,0	119	185
	at 70 m/sec...........	4325	2300	1560	1335	1330	1650	2160	2895	3800	5130	8600
Kg	at 10 m/sec...........	264	138	342	64	133	237	348,8	452	550	639	675
	at 70 m/sec...........	13750	6950	1695	3520	7150	12550	17750	22200	26800	30500	32000

Proposed Activities of the National Aeronautic Association

THE following activities have been suggested to the National Aeronautic Association by William Knight which we endorse unreservedly.

AERIAL AGE has repeatedly supported the N. A. A. during the last eight months that this Association has been in existence. We feel however that the time has arrived when the N. A. A. shall begin to fulfill, at least in part, the program of activities outlined in its by-laws.—We feel that it is essential to create *services* to the membership and to initiate some sort of constructive action for making *"America first in the Air"* before the N. A. A. can honestly ask the support of a large membership.

We are confident that those who for the time being are in charge of the destinies of the N. A. A. will immediately act upon the suggestions made by W. Knight which, in our estimation, should be the foundation of the *Services* for which the N. A. A. has been created.

April 15, 1923

National Aeronautic Association of U. S. A.

The following activities are hereby suggested for the following Committees of which I have been appointed Vice-Chairman and of which I am at present the acting Chairman:

Foreign Relations Committee

It should be the functions of this committee to establish and to maintain a cordial exchange of information between scientists, technical and business men, aircraft manufacturers, aeronautical laboratories, aerial operating companies, aero clubs, aeronautical Chambers of Commerce, engineering societies and aeronautical organizations of any kind, both in this country and in Europe.

In order to make this work available to the membership at large and in order to be able to supply exact data and information on any particular subject, a list of publications and reports received from foreign countries should be published monthly in the aeronautic press, giving a brief outline of the information available.

Reports issued in a foreign language and new important articles appearing in the foreign aeronautical press should be either translated or abstracted into English according to their order of importance and should be published in the aeronautic press so as to make them available to the largest possible number of people.

The foreign relations committee should also provide for the N. A. A., being properly represented in any meeting and conference taking place in Europe where aeronautic matters of a general interest to all countries are discussed and should supply the N. A. A. representatives abroad attending these conferences and meetings with sufficient data about the aeronautic situation in the United States so as to enable them to properly represent us.

Also, the foreign relations committee should endeavor to facilitate the task of members of the Association going abroad in connection with aeronautic business or investigations in Europe, by supplying them with letters of introduction to people in Europe who can facilitate their work. A similar courtesy should be extended to foreigners coming to the U. S. A. on aeronautic business who are sent to us by our correspondents abroad.

In other words, the activities of this committee should be so directed as to make the N. A. A. the connecting link between aeronautic interests in the United States and in Europe and should be the authoritative source of information for the membership of the Association about everything concerning the aeronautic progress outside of the United States.

Industrial Relations Committee

The work of this committee should be particularly concerned with the liaison between aircraft manufacturers, aerial operating companies, engineering societies and the Government, in all matter in which the cooperation of these various organizations is concerned. This committee should keep a close track of production facilities available in the aircraft manufacturing industry in the United States and of up to date manufacturing methods and standardization, and should coordinate the work done at present by a number of organizations without much liaison.

It should also be the function of this committee to make a study of the matter of subsidies to be granted to aerial operating companies in connection with the transportation of mail and other services rendered to the Government and to make recommendations on this matter.

The subject of contracts to be awarded by the Government to aircraft manufacturers for the construction of military and naval aircraft and the best methods to be followed in this respect should also be the object of investigation by this committee.

The committee should endeavor to become the connecting link between aircraft manufacturers, aerial operating companies and the Government, and in every way, should encourage the development of commercial types of aircraft well suited to this kind of service required of them. This can be accomplished by promoting the establishment of suitable prizes for the right design of aircraft and power plant and by having the necessary amount of money invested in development work. Therefore, it should be the task of this Committee to find out what is needed in the matter, what can be done at the present time, to invite the cooperation of all concerned, and to follow up the work of cooperation between the various branches of the aeronautic industry and the government.

Scientific Research Committee

This committe should follow up the scientific research work being done in this country and abroad and should act as a clearing house of information and data for every individual and organization interested in the scientific end of aeronautic work, and should make available to the membership at large as much as possible of this work through articles published in the aeronautic press. This Committee will have to work in close connection with the Foreign Relations Committee for exchanging information and data with scientists in Europe.

Office of Aeronautical Intelligence

To carry out properly all of the work briefly outlined above, quite evidently shall require a sufficient clerical staff that we do not possess at present. There shall be a considerable amount of correspondence to be done and a good deal of translation work.

At the beginning I would suggest that we engage a translator possessing a good knowledge of foreign language so that we might be able to start the work.

One of the first things that we should do is to organize an office of aeronautical intelligence for keeping track of whatever is published both in the National and in the Foreign press on all subjects connected with the technical and the business aspect of aeronautics. Quite evidently, as we grow, requests for exact data and information on all phases of aeronautics will be sent to us from every section of the country and we must be prepared to answer them. This we cannot accomplish unless we organize this work before-hand.

WILLIAM KNIGHT

Vice-Chairman, Committees on Foreign, Industrial Relations and Scientific Research

Howard E. Coffin, Pres. B. H. Mulvihill, V. Pres. B. F. Castle, Treas. John B. Coleman, Rec. Sec.

Official Bulletin of National Aeronautic Association of U. S. A.

Col. H. E. Hartney, General Manager Cable Address, Nataero
National Headquarters, 26 Jackson Place, Washington, D. C.

The National Aeronautic Association of U.S.A. assumes responsibility for the statements under this heading

BY courtesy of the Editor of Aerial Age, the National Aeronautic Association issues the following bulletin to its members:—

The following changes have taken place on the Board of Governors since the issuance of the June Bulletin:

Charles S. Reiman, governor of the 6th district has resigned on account of ill health. Mr. Reiman has been dangerously ill and has been obliged to give up all business and accordingly, the governors of the association regretfully accepted his resignation, which took effect June 15th.

To fill the vacancy on the Board of Governors in the Second District, Captain Theodore Knight has been elected governor. Captain Knight is one of the leaders in aeronautics in this district and the association is fortunate in securing the active aid and support of a man of such business acumen and prominence as Captain Knight.

Colonel H. E. Hartney, formerly acting general manager at national headquarters in Washington, is now vice president of the General Airways System, Inc., with offices in Washington. Colonel Hartney is no longer officially connected with the association.

On Tuesday evening, June 6th, the Philadelphia Chapter was formed following a dinner at the Bellevue Stratford Hotel. The charter was presented by Conway W. Cooke, chairman of the membership committee of the association, and the officers of the chapter were elected as follows:—Hollingshead Taylor, president; Samuel B. Eckert, vice president; and C. T. Ludington, secretary-treasurer. The following were elected to serve as directors: W. W. Kellert, president of the Aero Club of Pennsylvania; C. G. Ireland, R. G. Miller, R. P. Strine, H. N. Taylor, C. T. Ludington and S. B. Eckert.

The principal guests of the evening were Lieuts. Oakley G. Kelly and John A. Macready, who recently made the world's record for sustained flight, from New York to San Diego in 27 hours. Other guests were Admiral W. G. Harris, general manager of the Philadelphia Navy Yard; Vice President B. H. Mulvihill, N. A. A.; Edward Schildhauer, formerly chief electrical and mechanical engineer of the Panama Canal, and now chief electrical engineer of the American Investigation Corporation, a huge airship company; Commander C. G. Westervelt, manager of the Navy's Aircraft Factory at Philadelphia; Commander J. H. Klein Jr., executive officer of the Navy's Rigid Airship ZR-1; Commander H. W. Richardson, one of the pilots of the Navy's trans-Atlantic Flight; Lieut. C. A. Tinker, director of information of the N. A. A.; and Lieut. L. B. Mollison, aero officer of the Third Army Corps Area.

The principal speaker of the evening was Admiral Harris, followed by Lieuts. Kelly and Macready, who gave thrilling accounts of their trans-continental flight and the altitude flight of Lieut. Macready, who reached a height above sea level of 40,260 feet. Mr. Schildhauer, Capt. Cooke and Lieut. Tinker also spoke concerning the activities of the N. A. A.

Fifteen students of the Philadelphia Episcopal Academy who have formed the junior branch of the Philadelphia chapter, were present, and Alfred Ostheimer, 3rd., who headed the delegation, promises that the branch will be extended to include practically all of the students at the Academy, which will total nearly 300.

Moving pictures were shown of the trans-Atlantic flight and the Army's activities at McCook Field, which gave a very comprehensive idea of the methods employed by the Army Air Service in developing aircraft of reliability and usefulness in war and peace.

The following interview with Lieuts. Kelly and Macready was printed in the Philadelphia Ledger:—

Perhaps it is that eight months of overalls and grease with days and nights crowded with hope and doubt and a dozen other emotions battling for supremacy, can persuade a man that he is not a hero after he has achieved the almost impossible. Or perhaps it is merely the Army's system of effacing the individual and transforming him into a unit for the glorification of the service. The answer certainly is not to be found in the two men who did the almost inconceivable—a non-stop transcontinental air flight.

Lieutenants Kelly and Macready are not romanticists. They dream and hope for the best, but always in the iron-clad regulation army manner, and leave the weaving of romance to the public.

"It was a great flight, of course", said Lieut. Macready last night, "but when we landed on the coast after our trip, we certainly could not understand all the hurrahing of the people."

There is nothing in their appearance or manner to distinguish them from any other army aviators—just two happy, smiling, blue-eyed men who have found a strong anchorage in the army and aviation and probably would be at a loss what to do if they didn't have airplanes to fly and tinker with.

And the flight—Lieut. Kelly looked serious a moment as though peering into the past for something.

"That night watchman who said he saw us over Kansas City must have been dreaming", he said, "He was a darn poor watchman because we were not within 100 miles of that old town and we didn't want to be."

They realize now what they have accomplished—for aviation. But the long months of toil, of sleepless nights and worry, of test flights and endurance flights with the giant T-2 machine, is still the outstanding thought in their minds.

A successful flight consuming twenty-four hours cannot quite overcome those eight months of toil with grease-smeared faces and hands, and brains that ached for a rest.

And then, when the thing was accomplished the reality was bare, stripped of illusion and romance—just another flight.

"It wasn't until three days after it was over that we really knew what we had done", said Lieut. Macready. "We had dreamed of it so long and worked so hard that when it really came it was not so big after all."

"The public", said Lieut. Kelly, "thinks of this flight only as something never done before. They forget, if they knew about it at all, our hard work and study."

Lieut. Macready agreed with him on that score.

"It was a big week's work for me", he said, "I made that flight, won some money and topped it off by getting married".

Both men are fatalists as far as their careers are concerned. They like the army and intend to stay in it. And the future—well, Kelly is going to Mitchell Field, Long Island now.

"That flight doesn't mean anything to the army as far as Macready and I go", said Kelly. "We don't take our pick of places to go. We have to obey orders the same as any of the others. That's that!"

"And what were your sensations when you were flying?"

Lieut. Macready racked his mind for a suitable answer.

"What would they be after eight months of hard work and hoping? We hurried to New York, got the latest observations of the Weather Bureau, went out to Mitchell Field and made the final preparations. We were dog-tired and sleepy. Then we hopped off."

One could easily picture them crouched in the cockpit, peering into the gloom ahead, their eyes tense, the tiny wrinkles contracting as they sped through the air.

"There was no sleep for either of us. And we knew every place we passed," said Macready.

But the predominating thing in both men is their sincerity and love of flying and their fatalistic outlook for the future.

Two men who have achieved one of the greatest things in present day flying—Kelly wishing he could have stayed at San Diego and Macready still the hero of his own honeymoon.

Chapter activities are going on throughout the country in a very gratifying manner. Davenport, Iowa, has charter No. 3 and Akron, Ohio, has No. 4 for their local chapters, while applications for charters, up to June 14th, in addition to those already noted, have been received from Pittsburgh, Detroit, Miami, and Pensacola, Fla., Nashville, Tenn., Savannah, Ga., Waterloo, Iowa, Boston, Lowell, Springfield and Worcester, Mass., and Manchester, N. H., as well as many others, bringing the total number of cities and towns in which chapter activities are under way, up to 162.

NATIONAL AERONAUTIC ASSN.
By: C. A. Tinker,
Director of Information.

THE NEWS of THE MONTH

Flight of ZR-3 from Germany to United States

The French magazine "L'Air", 15 April 1923, contains the following note stated to have been supplied by Mr. Benisovich, who, in September 1922, attended a conference at Baden-Baden where Dr. Eckener of the Zeppelin Company revealed certain details relative to the ZR-3. The conference had for its object to present to a group of representatives of Insurance Companies the risk which they were assuming; viz: the flight of the airship from Germany to the United States.

"Property Insured—Airship delivered by German Government to the United States on account of reparation in kind for the sum of 3,000-000 Gold Marks. The Zeppelin works are responsible for the risk of transport to the United States.

"Duration of Risk—The risk commences at the moment the airship leaves the hanger in Germany (Staaken near Berlin probably), to be completed upon landing in the United States (Lakehurst probably) at the moment when American personnel take charge. Risks of flight only are covered and not risks after landing or going out or going into the hangar.

"The experience of the Zeppelin Company which has constructed more than 100 airships, as well as the discipline of the German crew, present a substantial guarantee that no accident should take place in flight. The Airship will be subjected before her trans-Atlantic flight to an examination of experts and will carry out one or more test flights.

"Details of Construction—The Council of Ambassadors has designated the size of the airship at 70,000 cu.m. Based upon this figure the Zeppelin Company adopted as model the Bodensee, of which the length is 200 m. and diameter 28 m. approximately.

"The airship can carry 43 Tons of load; speed will be 130 km. given by five (5) engines of 400 H.P. each. The voyage of 7,000 km. could be made at a speed of 115 km. in 60 hours approximately, without taking into consideration contrary winds. A wind of 10 m. per second will prolong the voyage to 90 hours. Taking into consideration atmospheric conditions over the Atlantic Ocean and the modification of head winds by lateral currents, a time of 70 or 80 hours is counted on for the flight. A provision of 30 Tons of gasoline is sufficient for flight at 115 km. per hour for about 105 hours, giving a margin of 40 or 50%. By reducing the consumption of fuel 50%, the speed is reduced to 90 km.

"By making this demonstration the Zeppelin Company show their confidence and the successful completion of this voyage will permit them to offer their services to international capital for airship navigation over long distances without intermediate stops."

© Photo U. S. Army Air Service.

The "Leviathan" on its way from Newport News to Boston

Naval Aircraft Factory Designers Win British Glider Prize

The twenty-five pound prize for the best design for a glider, which was offered by the British Magazine "Flight", has been divided between two designs which were tied for first place. One of the successful designs was submitted by R. G. Miller and D. T. Brown, Aeronautical Engineers, employed at the Naval Aircraft Factory, Philadelphia. The design of Messrs. Miller and Brown was of a semi-internally braced monoplane with plane area of 172 square feet, span of 32 feet and weight of 300 pounds loaded.

The Passing of a Pioneer Airman

The death of Major Thomas Scott Baldwin at Buffalo, N. Y., marked the passing of one of the earliest pioneers in the world of aeronautics. He was the originator of the parachute and had the distinction of being the first man in the United States to descend from a balloon in a parachute, a feat which he performed at San Francisco, Calif., on January 30, 1885.

Major Baldwin was born in Berrien County, Mo., January 30, 1854, and his flying activities extended from 1875 to 1921. There is probably no individual in the world today possessing the knowledge and experience which Major Baldwin had in connection with the building and flying of lighter-than-air craft. His experience included both the manufacture and flying of spherical balloons, hot air and gas, and dirigible balloons. In 1893 he operated at the World's Fair in Chicago the first balloon owned by the United States Signal Corps.

He was a manufacturer of airplanes for five years until enjoined by the Wright Brothers; was an aviator for five years, and held three international licenses for spherical balloons, dirigible balloons and as an aviator. His experiences included exhibition work in operating balloons in all parts of the world.

For two years he served as General Manager of the Curtiss Airplane Co., and prior to the outbreak of the war he conducted the Curtiss Aviation School at Newport News, Va., which he organized.

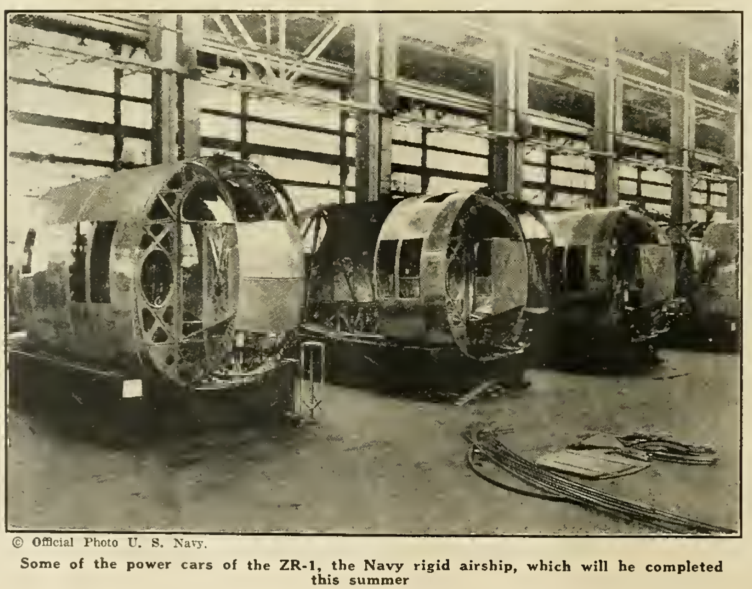
In August, 1917, he was ordered to active duty as Captain in the Army Air Service and assigned as Chief of Army Balloon Inspection, with headquarters at Akron, Ohio, where he personally supervised the construction and inspection of the entire balloon program of the Army. Upon his discharge from the military service he was appointed District Manager of Balloon Production and Inspection at Akron, Ohio, having complete supervision of the inspection and production of the lighter-than-air equipment of the Army Air Service.

One of his prized mementos was a four-karat diamond ring presented him by the King of England in recognition of his flying feats in that country.

Major Baldwin was a member of the Aero Club of America, Elks, No. 1 of New York, Odd Fellows, K. of P., and a 32nd degree Mason.

All Metal Commercial Plane Tested

The "Air Sedan", a Stout all-metal monoplane built for commercial purposes, is being tested out at Selfridge Field, Mt. Clemens, Mich., and is attracting considerable attention in and about Detroit. It is a three-passenger craft equipped with a Curtiss OX5 motor, and is showing up very satisfactorily.



© Official Photo U. S. Navy.

Some of the power cars of the ZR-1, the Navy rigid airship, which will he completed this summer

No Change in Nationality Mark of American Aircraft

A report has been recently spread to the effect that at the last session of the International Commissioners for Aerial Navigation, held at Brussels, Belgium, recently, the nationality mark assigned to Norway, was the letter "N". This letter had been previously designated as the nationality mark of United States aircraft. It was also reported that the new nationality mark for United States aircraft was to be the letter "W".

These reports had been based on a misconception of the decisions taken at Brussels. According to the minutes of the third session of the International Commissioners for Aerial Navigation, the letter "E" was granted to Norway as that country's nationality mark, with the letter "N" as the first letter of the registration mark.

The letter "N" therefore, remains the nationality mark for United States aircraft. This statement is made on the authority of the Controller General of Civil Aviation of Canada in a dispatch to the National Aeronautic Association.

Florida Proposes to Spend $100,000 for Air Terminals

The State of Florida under the terms of a bill now before the Legislature proposes to appropriate $100,000 as a fund for "the aid of aerial transportation into and within the State of Florida", according to information just received by the Aeronautical Chamber of Commerce. The proposal has attracted nation-wide attention, as in the preamble of the bill the principle is recognized that the war investment in American aviation should be realized for the benefit of commerce and industry, through the establishment of public facilities, lacking which, aerial transportation lines cannot reasonably be expected to operate.

It is proposed that the sum "be expended in defraying one half the cost and expenses of buying suitable location for the erection of and in erecting suitable hangars and workshops for the housing and care of the flying machines of bona fide aerial transportation persons, firms or corporations operating" within the State.

Conditions imposed are "that one or more countries and / or municipalities of the State of Florida, jointly and severally, directly or indirectly, defray one-half of the expenses of buying locations for the erection of and in erecting the buildings"; and that the respective counties and/ or municipalities defraying one-half of the said expenses........shall govern and control the franchising and leasing gratuitously the respective hangars to bona fide operators. To qualify as a "bona fide operator" an organization must have five or more aircraft utilized in the transportation of passengers, mail or express.

"While subsidies in the form of cash bounties as paid to operators by practically all the European governments, are looked upon with disfavor in the United States", the Aeronautical Chamber of Commerce said, "it has been repeatedly advanced by students of aviation that national policy urges the establishment of public owned and controlled terminals as these constitute probably the major expense in physical equipment and also in the future may be the key to proper regulation or to satisfactory utilization of all our aerial resources for national security. The Experiment is especially interesting because of the lack of surface transportation facilities in the Florida peninsula. Until recently there were few good roads and even now to travel by rail from Miami to Tampa or Jacksonville requires from 12 to 24 hours as compared with a few hours by air. According to reports received by the Aeronautical Chamber of Commerce there were three established aircraft operating activities in the State of Florida in 1920 and 1921 and four in 1922."

Cross Country Flying Made Easy

Airport and landing field maps and "blue books" of the air—everybody fly!

The Airways Section of the Army Air Service has just produced a map of the United States, which, it is hoped, will be freely obtainable by all who have flying to do, on a scale of 1/4,000,000 or 63 miles to the inch, on which are located all Government or Army fields, Navy or Marine aerodromes, Air Mail stations, Municipal airports and all Commercial, Emergency and Seaplane steps. Each type or classification of field above has its dot on the map a distinctive color. In addition, lines have been drawn between centers of population and industry to indicate probable routes for commercial air lines. Some three thousand-plus fields are located on the map. All we need is a supply of commercial airplanes—flying.

Let's put "Hop in Noble" on the country's airplanes for the next Shriners' convention.

Information Circular No. 404 has just been issued by the Army Air Service. This gives a full description of various types of fields, tells how they should be laid out and marked, together with a list of nearly four thousand towns where landings may be made, each field being designated, described, located with altitude reading, and a statement as to the availability of supplies.

Navy Grants Newport Site For New York Air Line

Assistant Secretary of the Navy, Theodore Roosevelt has sent Capt. Frank Taylor Evans word that the Navy Department is pleased with the selection of Coddington Point, its Newport naval cantonment, as the Newport terminal of the air line from New York.

The department, anxious to aid commercial aviation on a project that will attract countrywide attention, will grant use of Government land and buildings as soon as a formal request is received from the city of Newport. Capt. Evans was told that the Navy Department was anxious to co-operate in every way possible, and that further instructions would be sent him upon receipt of the city's request.

The city government is also considering the creation of an air commission to further promote the project that Messrs. Vincent Astor and T. Suffern Tailer started.

Loening Air Yacht in Record Flight

A remarkable record flight was made May 15 by Lt. Chas. B. Austin, U. S. N., Pilot of one of the new Loening flying yachts, with his mechanic H. B. Wiedercamp and Mr. Grover C. Loening.

The flying boat left the Loening airport landing at 31st Street and East River, New York, at 10:30 A. M., and landed at Hampton Roads, Virginia, at one o'clock—two hours and a half later, making an average speed of 120 miles per hour for the distance of 310 miles. This breaks all speed records for flying boats. The machine used in today's flight is of type similar to the fleet of flying boats built this spring for the New York-Newport Air Service, to be operated between New York and Newport this summer.

Contract Awaits New York-Chicago Air Line

The definite offer of an express contract to an airplane line operating between New York and Chicago awaits acceptance, Robert E. M. Cowie, vice-president of the American Railway Express Co. today assured the National Aeronautic Association.

Not only will the American Railway Express Co. enter into a contract with a properly organized air service company, but it will exploit the faster service, advertise rates, pick up shipments at points of origin and deliver them for air transportation at main-line air ports.

"I firmly believe the day will soon come when some well-organized airplane service will be in the field to conduct a regular commercial transportation business between New York and Chicago and other large cities in this country," said Mr. Cowie. "Gradually that day is approaching under the impetus of the informative work carried on by the National Aeronautic Association. I have been approached by many persons interested in air transport, and I have told them all that the need was for establishing the operating line and then we will be immediately ready to make a contract.

"Our idea is that commercial aviation is the next evolution in transportation for light, non-bulky packages of an emergency character, where the saving in time rather than the charge is the controlling factor. I have steadfastly advocated that when a service of this kind is set up it should be installed between New York and Chicago. To make the saving in time substantial," declared Mr. Cowie, "it should contemplate night flying, so that the present schedule by the fastest express trains between these cities, which makes delivery possible on the second day, would be cut in two by affording delivery on the first morning out.

Asked what the traffic between New York and Chicago for an air service would amount to, Mr. Cowie said one could not make a forecast. "It will never be known until it is tried," he added. "Nobody could have predicted with certainty when the telephone first came into use how extensively it would be used," he said.

"The American Railway Express Co. stands ready to consider a contractual arrangement for a service of this kind just as soon as an adequate and dependable airplane service is available. When an air express service between New York and Chicago is inaugurated," he declared, "I feel certain that the public will find a use for it."

Wright Aeronautic Corporation Activities

Two of the most important recent developments in the aeronautical industry are the entry of the Wright Aeronautical Corporation into the field of airplane manufacturing and the acquisition by the Wright Corporation of the Lawrence Aero Engine Corporation of New York City, as contained in the following announcement recently made by Mr. F. B. Rentschler, President of the Company:

"After careful consideration, our company is now providing facilities for carrying on the experimental development of plane types. It is believed that active development of complete units for aircraft will ultimately make for the best product. We expect to have ready for occupation shortly a new plant, constructed alongside our present one, which will house our plane development activities. This plant will be just as modern in every detail as our present one, and will be sufficient to carry out our present program. We are also negotiating for flying facilities at some place adjacent and convenient to Paterson. Because of the intense concentration necessary during the war, it seemed advisable for our company to devote its entire activities to the development and manufacture of aeronautical engines. It was, therefore, quite natural that at the end of the war period we should continue to engage principally in the manufacture and development of engines. It is, of course, entirely consistent that the organization bearing the name of Wright should eventually resume the development and manufacture of complete airplanes.

"The Wright Aeronautical Corporation announces that it has acquired by merger the assets and business of the Lawrence Aero Engine Corporation. By this acquisition, the Wright Company adds to its present line of water cooled airplane motors the Lawrence line of air cooled motors. The Lawrence Company has been the pioneer for some years in the development of air cooled motors and today has the only fully developed line of air cooled airplane motors now being produced in this country. At least, for the smaller powers, this type of motor has been becoming steadily more prominent for airplane use. Therefore, the acquisition of the Lawrence Company by the Wright Company should materially broaden the market for the Wright Company. Charles L. Lawrence, who has been successful in the development of the Lawrence Company business will become Vice-President of the Wright Company and will continue his active work in the development of airplane motors through the medium of the enlarged Wright Aeronautical Corporation."

Curtiss Planes in China

The Great China Airways Company will use 24 Curtiss machines to operate over five routes. The first route, expected to be opened shortly, will be from Tientsin to Peking, to Kalgan and Uruga. The second line is planned from Shanghai to Chengtu with a stop at Hankow.

The Government has agreed to permit the use of government landing fields at Peking and Tientsin in order to encourage commercial aviation.

This is the first legal sale of American planes to China in competition with the British, except for six Curtiss planes sold last year for training purposes.

Aeronautical Chamber of Commerce Membership

Practically every concern and individual belonging to the Chamber during 1922 has continued its membership. There are now well over two two hundred (200) members in the three classes.

Among those who recently acquired membership, are the following:

CLASS "B"

Aircraft Development Corp., General Motors Bldg., Detroit, Mich., American Gas Accumulator Co., Elizabeth, N. J., Eberhart Steel Products Co., 812 E. Ferry St., Buffalo, N. Y., Great Lakes Aerial Photographic Co., 11511 Mayfield Road., Cleveland, O.,Haskelite Mfg. Corporation, 819 Chamber of Commerce Bldg., Chicago, Ill., Luftschiffbau-Zeppelin, Mr. Harry Vissering, American Rep., 14 E. Jackson Blvd., Chicago, Ill., Sperry Gyroscopic Co., Manhattan Bridge Plaza, Brooklyn, N. Y., U. S. Touring Information Bureau, Inc., Waterloo, Iowa, Wyman Gordon Co., Worcester, Mass.

CLASS "C"

Richard H. Depew, 136 W. 52nd St., New York City, Orton Hoover, Curtiss Aeroplane Export Corp., c/o U. S. A. Consulate, Rio de Janeiro, Brazil, C. S. Jones, Curtiss Aeroplane & Motor Corp., Garden City, N. Y., Lawrence Leon, Curtiss Aeroplane Export Corp., 818 Via Monte, Buenos Aires, Argentina, Fred M. Ruddell, Kokomo, Indiana, S. Albert Reed, 113 E. 55th St., New York City, H. Von Thaden, Aircraft Development Corp., General Motors Bldg., Detroit, Mich.

Contract Awarded to L-W-F Engineering Company

Three contracts for 56 planes at a total cost of $829,870.10 have been awarded to L-W-F. Two of the contracts are for the Navy and the other for the Army, according to recent press reports.

An award of $3,500 was made to the L-W-F Engineering Company for their design for Type T-3 plane. This type plane is designed primarily for Army transport work, carrying six passengers and a crew of two with baggage. They can readily be converted into bombers or to carry over a ton of freight.

One of the Navy contracts is for 20 torpedo planes, type LT-2 biplane. The second Navy contract is for 26 Type 1, 3 seater observation planes.

The company is just completing a contract for 35 Martin bombers.

At the present time L-W-F employs 350 skilled workmen.

U. S. Touring Information Bureau, Inc.

Among those organizations that have recently acquired membership in the Aeronautical Chamber of Commerce is the U. S. Touring Information Bureau. In co-operation with the Chamber, the National Aeronautic Association and the War Department the Bureau has compiled comprehensive data on landing fields throughout the United States and has printed an addenda to their regular directory, and a specially prepared map showing the location of some 3000 improved and unimproved landing fields.

State Legislation

Failure of Congress to pass the Winslow Bill, providing for a Bureau of Civil Aeronautics in the Department of Commerce, lead to consideration by many State Legislatures of an Aviation Code which was inadequate to meet the situation.

The Aeronautical Chamber of Commerce, through its various State Committeemen and in co-operation with the National Aeronautic Association, have pursuaded several State Legislatures to withhold final action on such legislation.

One particular instance is the case of the Pennsylvania State Legislature where, through the co-operation of the Aeronautic Association and our State Committeeman, Mr. W. Wallace Kellett, who is President of the Pennsylvania Aero Club, the Legislature was pursuaded to withhold passage of an Aviation Code until after the conference arranged by the National Aeronautic Association with the Commissioners on Uniform State Laws, which is called for next August.

Loening Air Yacht Record Flight

Mr. Grover C. Loening in one of the new Loening flying boats made a non-stop flight from New York to Hampton Roads, 310 miles, in two and one half hours, at an average speed of 120 miles an hour.

U. S. Chamber of Commerce Advocates Federal Legislation Governing Aircraft

At a meeting held in New York on May 10th, of the U. S. Chamber of Commerce, of which the Aeronautical Chamber of Commerce is a member, the following resolution was passed:

"Aviation has demonstrated great possibilities for the addition of new services to commerce and important means of national defence. That these possibilities may be developed and their national benefits obtained, commercial aviation should receive prompt and sustained encouragement. As requisite to this end, suitable legislation should immediately be enacted by Congress to govern the flight of aircraft and the airways over which they operate."

Commercial Operations in Colombia, S. A.

Mr. James Otis of 310 California Street, San Francisco, California, an exporter, recently visited the office of the Aeronautical Chamber of Commerce and furnished some very interesting information and photographs of aviation activities in Colombia, South America.

Mr. Otis has extensive business interests in South and Central America and during his last trip he made a special study of the efforts being made by a group of Germans to extend aeronautical activities in that territory.

The enterprise was started upon the initiative of the German Consul at Bogota, Colombia, who secured a considerable amount of capital, fifty per cent of it being contributed by Germans living in Colombia and the balance by native Colombia bankers and commercial houses having foreign interests.

Sociedad Colombo—Alemanade Transportes Aereos is the name of the line. It operates over a 600-mile route up the Magdalena River, starting from Barranquilla and ending at Guardot.

The equipment consists of six all-metal Junkers equipped with pontoons.

The line is heavily patronized for the transportation of mail, freight and passengers. During the year 1922, 205,990 kilometers were flown in 1567 hours and 46 minutes, a total of 526 flights. 1137 passengers were carried and 4,834 kilograms of mail and 1143 kgs. of parcel post.

The company has the privilege of issuing and selling its own postage stamps and charging whatever rate it wishes for the transportation of mail.

The company employs 30 persons, 29 of whom are Germans.

New Farman Undercarriage

We present a view of the new Farman undercarriage on the 1923 Farman Sport plane and other Farman models. The principle of this new landing gear is quite simple and apparent.

The landing gear wheels and their axle are placed not as usual at the point of the "V" of the landing gear strut, but some distance ahead of this point. A wooden ski connects each wheel with the "V" strut of the landing gear and runs on back to the ground. The ski is attached to the "V" strut by a cable in front and rear.

This arrangement moves back considerably the center of gravity of the machine behind the point of contact of the landing gear wheels. The weight of the machine is equally distributed between the wheels and the heels of the skis, which act as a brake and eliminate long rolling of the machine.

It is also possible to make a quick take-off, as the motor will run full out, and the tail of the machine is raised, thus releasing the brake or ski and sending the machine off very quickly. In actual tests, landings have been made without difficulty in 20 ft. and take-offs in the space of some 60 ft.

It is almost impossible to nose this machine over even when making a landing in a ploughed field.

The new Farman undercarriage

Ludington Exhibition Company

This Company has been formed for the purpose of demonstrating and exhibiting the 1923 model Sport Farman 2 seater. At present, flying is being done from the field of C. S. Ireland, Curtiss Eastern distributor, at Pine Valley, N. J. twelve miles East of Philadelphia.

The performance of this little ship has attracted considerable attention. Its span is 23 ft. 3 in. and its length 19 ft. 11 in. The weight empty is 450 pounds and loaded 890 pounds, the useful load being 350 pounds. This Company is using the 6 cylinder 60 H. P. Anzani motor. It appears to be eminently satisfactory and produces a maximum speed of 85 miles per hour at just over 1250 r. p. m., while the ship has been flown at 800 r. p. m. at speeds around 30 miles per hour with the greatest ease. The climbing ability is remarkable being in the neighborhood of a thousand feet a minute. The operating costs are extremely low, the fuel consumption being less than four gallons an hour.

It is planned to enter this machine in all events for which it is eligible at every officially sanctioned meet it can attend. Although the Sport Farman is capable of performing every known acrobatic maneuver, it is the policy of the Company not to permit its use for stunting purposes and to acquaint the public in every possible way with the safety of properly controlling flying. The Company is anxious to be notified of any and all meets that are to be held during the coming season, so that it may complete its schedule.

The officers of the Company are: C. T. Ludington, President and Treasurer. W. S. Ludington, Vice-President. W. Wallace Kellett, Secretary. Robert P. Hewitt, Pilot.

Aero Exposition in Detroit

With the opening of the Detroit Coliseum at the fair grounds as an all year round exposition building, plans are now being perfected for the holding of the first annual Airplane Exposition ever staged in the Michigan metropolis in the new structure from December 5th to 9th, this year.

The exposition will be for the entire state industry, and will have the attention of all branches of the trade throughout the state. Invitations are being sent to Ohio and Indiana organizations to join in the movement and very favorable responses have been had to date from several of the big bodies, with a view of developing a TRI-STATE organization at the show.

The Coliseum is the finest exposition building in America and next to the Olympia, the largest in the world for affairs of this kind. It lends itself easily to decorations and by a series of terraces can hold an exposition of 300 exhibits on one floor where every exhibitor's sign is visible to the entire gathering at the same time. There are numerous convention halls, complete banquet halls and committee rooms to accommodate any kind of emergency.

Mail Flier Proposes Trans-Continental Flight

Request for official recognition by the contest committee of the National Aeronautic Association of an air mail pilot's attempt to make a continuous flight alone from San Francisco to New York has been received at national headquarters of the association. The request was filed by A. C. Nelson, of Salt Lake City, superintendent of Western division, U. S. Air Mail Service.

The pilot, Clare K. Vance, of Logansport, Ind., is preparing to start within ten days upon this initial attempt in his own airplane to negotiate a non-stop transcontinental dash which he hopes to make in 20 hours.

Vance's airplane, which he built himself, weighs fully loaded 4,200 pounds and has a gas capacity of 350 gallons. Its maximum speed is 122 miles per hour and it is capable of climbing 13,000 feet. He plans to leave San Francisco at 10 o'clock at night and land in New York at 6 o'clock the following evening, taking the route through Omaha, Chicago, Cleveland.

His friends in the Air Mail Service are confident of his success and are hopeful that it will gain for Vance public recognition by the award of a purse for his hardihood. While Vance is on leave of absence from his mail duties, and his flight is in no way a part of the postal activities, his friends consider that if successful the flight will be the greatest performance in American aeronautics to date, and they are seeking to arouse interest in public recognition through a substantial reward.

Vance last February in a snowstorm made the first successful landing of an airplane on the crest of the Sierra Mountains after battling a 90-mile gale; he made his way to the Reno railway station with 300 pounds of mail and completed his trip to San Francisco by rail.

Metals and Their Alloys

Though "Metals and Their Alloys" (Charles Vickers) is merely a revision of a former edition, some chapters have been added based on a book called "Metallic Alloys" by Brannt. This has made the edition so much more complete, that practically a new book has resulted. The manner in which the new information is presented is superior to Brannt's method of presentation.

Charles Vickers is a practical foundryman who has for many years been in intimate contact with metals and metallurgical processes and has learned to know those problems that most frequently baffle the users of metals. His book gives some attention to chemical control and physical tests, but as a whole the author has refrained from technical discussions and the language he uses is that of the practical man talking to practical men. The chapters dealing with the recent developments of magnesium alloys and die-castings are particularly interesting.

Some of the chapter heads are as follows: Aluminum and Its Alloys, Copper-Tin Alloys, Steam and Electric Railroad Alloys, Manganese Bronze and White Brass, Nickel Alloys and Monel Metal, Foundry Utilization of Scrap Metals. In addition to these and several more interesting chapters, you will find a Glossary of Terms Used in the Foundry.

This book will probably meet with an enthusiastic reception from every one interested in the subject of metals. (Published by Henry Carey Baird & Co., Inc., 2 West 45th Street, New York.)

Air Ambulance Renders Assistance at Cape Hatteras

Another instance of medical assistance by air being rendered to outlying and inaccessible spots by naval airplane is furnished in a recent report from the Naval Air Station, Hampton Roads. A radio call from Cape Hatteras recently advised of the serious illness of Mr. T. J. Farrow. One of the station seaplanes was at once dispatched with a doctor and Mr. Farrow was brought back to the Protestant Hospital in Norfolk. Due to quick action and the speedy means of supplying medical attention afforded by airplane, it is said that the patient's life was saved.

Navy Fliers Make 17 World Records

American naval fliers, contesting at San Diego in events never before put on an official program, on June 7, established seven more world records in addition to the two they broke and the eight others they established yesterday, making a total of seventeen world records now held by the aircraft squadrons of the battle fleet here.

What naval fliers regard as a striking achievement was that of an F-5-L plane of the coastal mail type, which, piloted by Lieutenant H. E. Halland, lifted an extra weight of 2,000 kilograms (about 4,400 pounds), 5,200 feet. The total weight of the machine and load was 14,400 pounds.

This flight, said to be one of, if not the best of the kind, was made with a Liberty motor.

Another thrilling flight for an altitude record was made by Lieutenant Ralph Ofstie in a T-5 battle plane, with single seat and no extra load. He soared to 18,400 feet, encountering a temperature of two degrees below zero. The air was so rarefied that the air in the pontoons of the machine was largely sucked out and when the T-5 began to descend the pressure of the atmosphere without caved in the pontoons. The flight established a record.

Another record was made by Lieutenant Earl Brix, flying a torpedo plane, with an extra weight of 250 kilograms, to an altitude of 12,050 feet.

A world's record for seaplanes over a three kilometer course was established by aviators of the air squadrons of the battle fleet when Boatswain E. E. Reber, piloting a torpedo seaplane, attained a speed of 102.88 miles an hour.

Lieutenant L. D. Webb was second in the tests, making 102.78 miles an hour. He flew in an M-O monoplane recently added to the aerial equipment of the North Island naval air forces.

Lieutenant G. T. Cuddihy was forced to land when his T-S plane lost a propeller. He escaped injury.

Sets Helicopter Record

Pescara succeeded in making a flight of 121 meters in a helicopter on June 7, at Issy les Moulineaux. The previous record was 83 meters. Pescara's flight of 121 meters is equivalent to approximately 397 feet.

Langley Field Pilots Start Night Flying

The 2nd Bombardment Group at Langley Field, Va., has entered upon the program of night flying prescribed by the Chief of Air Service. On their first night a brilliant full moon favored the pilots, but it persisted in hiding itself behind heavy cloud banks every few minutes. Only the hangar flood lights and a field lighting set were used in illuminating the landing field. Two dual NBS-1's were used during the week, in order that every pilot could be given a check ride and a few landings. A large circle of red and white lights used in conjunction with illuminated panels regulated traffic. The present schedule calls for flying three nights a week regardless of the moon, and as soon as the pilots become proficient in landing, camera obscura flights will be made.

More DH4B Airplanes To Be Put in Commission

The shipment from the San Antonio Air Intermediate Depot, Kelly Field, Texas, of 130 DH-4 airplanes without motors to the Gallaudet Aircraft Corporation, Witteman Aircraft Corporation, Lawrence Sperry Aviation Corporation and Cox-Klemin Aircraft Corporation was completed on April 25th. These planes are to be remodeled into DH4B's, to be utilized in servicing the various Air Service fields, as the demand for this type is urgent. Mr. Roger Q. Williams, the joint representative of the four aircraft corporations contracted to remodel these ships, supervised the inspection and shipment of the planes.

New Airship Tested at Scott Field

The new airship of the SST type, which was recently completed at Scott Field under the supervision of Charles Brannigan, Chief Engineer for the Scott Field Air Intermediate Depot, was tried out on a test flight of one hour. The ship handled well and responded quickly to the controls. Its crew consisted of Lieuts. Chas. P. Clark, R. S. McCullough, pilots; and Mr. Charles Brannigan.

The capacity of the new airship is 100,000 cubic feet; length, 165 feet; height, 49 feet; width, 35.5 feet; speed, full cruising, 57.5 m.p.h.; useful load, 2240 lbs. Two Rolls-Royce, hawk type motors of 75 h.p. each furnish the motive power.

© Photo U. S. Army Air Service.

Target glider of the U. S. Army Air Service mounted on a "Jenny"

New Pursuit Airplane for the Army Air Service

Residents of the National Capital had an opportunity recently to view the latest type of pursuit airplane built for the Army Air Service by the Curtiss Airplane and Motor Corporation. The plane, piloted by Lieut. Wendell H. Brookley, Air Service, landed at Bolling Field from Mitchell Field, L. I., New York, making the trip in two hours and 20 minutes in the face of an adverse 15-mile wind. It is, of course, capable of much greater speed, but leaving New York in company with another plane it had to fly at reduced speed so as not to lose her less speedy companion, the pilot being forced to cut down the revolutions of his propeller from its maximum of 2250 per minute to 1450. Incidentally, the accompanying plane had engine trouble when over Baltimore and was forced to land in the Monumental City, arriving at Bolling Field an hour and a half later.

The general public conversant with the various high speed airplane records recently established by the Army Air Service has no doubt cast a questioning eye on the bearing these so called sporting events had on military aviation. The answer may be found in the advent of this new airplane. While this ship has all of the characteristics of the Curtiss Racer in which Lieuts. Maughan and Maitland startled the world with their ultra speed performances, it is, unlike the racer, designed for extremely efficient performance at high altitudes. This fact has necessitated the addition of more lifting area, which naturally materially cuts down its speed. In a recent flight an Army pilot drove this plane 152 miles an hour at an altitude of 15,000 feet.

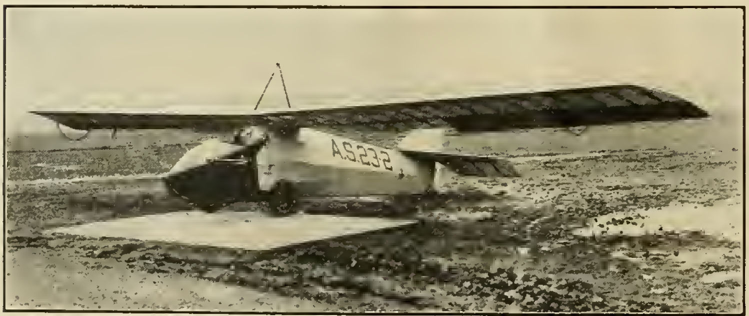
One of the outstanding features of the plane is its remarkable climbing ability. From the take-off she can climb 2500 feet in one minute, or at the astounding rate of 30 miles an hour; 1710 feet per minute from 6500 feet and 1390 feet per minute from an altitude of 15,000 feet. At the maximum altitude possible of attainment with its normal equipment (28,600 feet) it can skim along in this rarefied atmosphere at 113 miles an hour. At ground level the plane can "hit it up" at 169 miles an hour, some 17 miles per hour faster than the speediest pursuit ship now in service. Army Air Service officials contend that when equipped with a high-speed propeller the plane should better this mark considerably. At 20,000 feet altitude the plane can still rival the speed of its nearest competitor at ground level, being capable of traveling at the rate of 2½ miles per minute. The propeller of the plane delivers its maximum number of revolutions per minute (2250) at an altitude of 6500 feet.

Like the Curtiss Racer, this new pursuit ship is equipped with a Curtiss CD-12 engine, delivering 400 horsepower with very little vibration, thus indicating the skilful engineering put on the job. The weight of the plane empty is 1879 pounds, loaded 2784 pounds. The overall length is 22 feet, 10 inches; height, 8 feet, 8 inches; wing span 32 feet; positive stagger of wings, 34 inches; chord of upper wing, 5 feet; chord of lower wing, 4 feet; gap, 4 feet, 7 inches. The total wing area is 265.3 square feet. The landing speed is 61.5 miles per hour; 86 gallons of gasoline can be carried, which gives a cruising radius extending well over the two hours required for pursuit ships.

Extreme accessibility of vital parts is carried throughout the ship. The fuselage of steel construction may be opened in sections, with the greatest ease, by withdrawing a safetied rod, and all the engine parts can be quickly inspected or repaired with the minimum time and labor spent in the removal of the cowling.

The cockpit and wings are so arranged that the pilot obtains the greatest possible angle of vision. The landing gear axle hubs have shock absorbers, and the V-shaped axle feature enables the ship to land in rough terrain with the least risk.

General Wm. Mitchell, Assistant Chief of Air Service, one of the first pilots to fly the new ship, was well pleased with its performance, his comment being that "She runs like a sewing machine."



The McCook Field Glider "G. L. II"
© Photo U. S. Army Air Service.

Parachutes to be used on Cross Country Flights

The regular emergency parachute is now being issued at Kelly Field, upon request, to all pilots starting on cross-country flights. As soon as a sufficient number is obtained they will be required to be carried on all flights. Instruction in the packing of parachutes has been carried on at the field for the past month.

Test Over 3-Kilometer Course

Shortly following the one-kilometer and other test flights at Wilbur Wright Field, Dayton, Ohio, which resulted in a wholesale emigration of world's records from France to the United States, Lieut. Lester J. Maitland, Air Service, flew the three-kilometer course at a speed of 234.64 miles per hour. Because of the wind, however, but two crossings of the course could be made. In a second attempt two days later, Lieut. Maitland's plane met with an accident. The wheel was broken upon striking a rut, when the plane had taxied about 100 yards preparatory to a take-off. The airplane nosed over, cracking up the propeller and wings. To the great good fortune of the Air Service and of all who know him, Lieut. Maitland escaped uninjured. The propeller, which was used interchangeably on the ship flown by Lieut. R. L. Maughan as well as the one flown by Lieut. Maitland was the only one of its kind in existence, having been built especially for the R-6 Racers. A duplicate is already in course of construction, and it is hoped the other repairs to the airplane may soon be completed. Because of the broken propeller, Lieut. Maughan's flights also had to be postponed. Both of the pilots will again fly the three-kilometer course, however, as soon as the new propeller is available, and very interesting results are expected.

Another Non-Stop Flight Record

What is believed to be another record in the history of aviation in the United States was made by a Scott Field crew, flying in a new non-rigid airship, the AC-1, from Langley

Field, Va., to Scott Field, without a stop.

The AC-1 glided away from Langley Field at 2:36 p.m. Eastern time, Wednesday, May 2nd, and landed at Scott Field at 7: 00 a. m. the next day, having traversed the distance of about 800 miles in 17 hours and 24 minutes.

The crew of four Lieutenants and two Sergeants cooked their meals, played cards by electric lights, slept in bunks and shaved on the way. They wore ordinary uniforms, not the cumbersome flying togs, and were comfortable, despite the fact that the night was chilly and the atmosphere so foggy that the compass was their only guide.

The crew of the ship were Lieutenants C. W. McEntire, W. C. Farnum, R. S. Heald and A. H. Foster, Sergeants Brasty and Kerzoski.

The AC-1 is at present considered the Army's fastest airship, it's speed with full throttle being 67 m.p.h., 7 miles an hour faster than any other airship now in service. It has recently completed a series of experimental flights with helium gas, but has now been inflated with hydrogen gas. The length of the ship is 170 feet, the diameter 48 feet, and the gas capacity 190,000 cubic feet. It carries 330 gallons of gasoline, an amount sufficient to carry it for 30 hours at a 50 mile per hour cruising speed.

A special feature of the airship is an inclosed car, the first of its kind built in this country. It contains two rooms, the forward compartment being used for the operating cabin and crew's quarters, while the rear compartment carries the power plant. Two Aeromarine engines of 180 h. p. each furnish the motive power. The engines deliver their power through a transmission to two propellers which are carried on outriggers, one on each side of the car. The propellers operate at one-half engine speed. A reverse gear is attached to this transmission, which facilitates the maneuvering of the ship in landing.

In the engine room is also located a coffee percolator and a rather complete kitchenette. There is ample space for the crew to get the necessary sleep on good comfortable mattresses, with plenty of blankets, and to have the necessary shave in the morning. There are complete lavatory and toilet facilities. With the closed cabin and the absence of noise, it is not necessary for the crew to wear helmets, goggles, ear protectors, flying suits, and all the paraphernalia necessary in open type of aircraft, and conversation can be carried on without raising the voice.

Floodlight Used as a Signalling Device

An interesting experiment, and one which may prove of permanent value, was recently tried out at Mitchell Field, L. I., New York. An ordinary floodlight was connected with an electrically driven device which automatically made and broke the circuit. By flashing two dashes of three seconds each and two dots of one-half seconds each it was possible to spell out M I, the first two letters of the word MITCHELL, in the Morse International Code at intervals of twenty seconds. So far as is known, this is the first attempt made to positively identify a landing field to a pilot flying at night. In addition to the fact that the International Code is universally recognized, this system has economy in its favor, as the one light is lit less than one-half the time.

To accomplish this result by other means it would necessitate spelling out letters and symbols which would require several lights of the same candle power to secure equal visibility. A disappearing light would also be much more apt to catch a pilot's eye than a permanent light, due to the number of permanent lights which are visible in certain localities.

Captain Ira C. Eaker flew for nearly an hour to determine the effectiveness of the signals and upon landing stated that they were easily read from comparatively close range. The lack of range is attributed to the low candle power of the light used and the inability to secure a proper searchlight effect.

Plans are under way to use a stronger light and with certain improvements suggested by the experiment conducted, it is hoped to attain a visibility of ten miles. When same is achieved it is believed that this system will be a valuable aid to night flying.

Department of Photography Operating at Air Service Technical School

On March 5th last, the Department of Photography of the Air Service Technical School at Chanute Field, Rantoul, Ill., began the instruction of the first class in photography at that field. This department, formerly the Air Service School of Photography, was removed last summer from Langley Field to Chanute Field, and with the Communications and Mechanics Schools consolidated into the present Air Service Technical School.

The Photographic Department occupies two of the wooden type of hangars, the interiors of which, affording over 15,000 sq. ft. of floor space, having been partitioned into offices, work rooms and laboratories thoroughly equipped with necessary electric illumination, power, water supply and ventilation systems. The present school facilities are a decided improvement over those that existed at Langley Field, in that badly needed laboratories and work rooms are now afforded, and their arrangement is with reference to a clearly defined course of instruction and is not an attempt to adapt rooms in a building erected for other purposes to photographic school uses.

The course of instruction has been greatly enlarged and improved, and it is expected that later, in the form of the training regulations on photography, it will be available for training purposes in the Air Service. The course of instruction for officers of the Regular Army is 725 hours in length, or approximately 24 weeks; for Reserve Corps officers, three

Army airship A-C1, which made a non-stop flight from Langley Field, Va. to Scott Field on May 2-3.

months; and for enlisted students 408 hrs., or approximately 14 weeks. These courses differ one from the other not only in length of time required, but also in the subjects given. The course for Regular Army officers comprise instruction in 15 subjects; that for Reserve officers, 14 of these subjects, and that for enlisted men, 11 of the subjects. The eleven subjects which are common to the three courses—although the amount of time devoted to a subject varies with the course—are as follows: Elementary photography, photographic chemistry, negative making processes, printing processes, photographic optics, cameras, practical ground photography, copying, mosaic making, filters, and the work of a photo section. In addition, the course for Regular and Reserve officers includes practical aerial photography, the military uses of aerial photographs, photographic interpretation and aerial intelligence, and in the case of Regular officers only elementary topography.

Naval Planes will Make Extensive Survey of Alaskan Airport Facilities and Natural Resources

An extensive survey of Alaskan territory, with a view to ascertaining data on airports, airbases, and general coast line information of value to aviation projects, will be made this summer by two Navy DT seaplanes which will be attached to the commission headed by Rear Admiral Chase. The planes will leave San Diego, on May 25th, and will base on the USS CUYAMA during their operations in Alaskan waters. It is expected that information of value to conservation and development projects will be obtained in this manner from the air in territory and over terrain that is otherwise almost inaccessible. In addition to the survey that will be made in connection with airport and landing field facilities for government aircraft, photographic maps will be made and information will be gathered which will be of great value to the Coast and Geodetic Survey and the Alaskan Coal Commission. Aerial maps will be made by the planes which will furnish what would otherwise take months to obtain. Some of this information would be unobtainable except by the use of aircraft. One of the projects which will be undertaken is the completion of a difficult piece of triangulation for the Coast and Geodetic survey which by air will be accomplished in hours where weeks and months would be required if methods were used that have served in the past. The proposition is to establish triangulation points on Baranoff Island by aerial photography which may be used to plot in the territory from one coast to another. According to officials of the Coast and Geodetic Survey this work would require months of mountain climbing unless it is accomplished by naval planes.

It is also planned to make a survey of the Alaskan Oil Fields and of the Seal herds on the Alaskan Coast and in the surrounding waters. The planes that have been selected for this duty are the new service DT torpedo and bombing planes which have shown such exceptional qualities for service use. The fact that they may be used for such extensive peace time duties is considered as an added proof of their value for service use. The planes will be piloted by Lieutenants E. B. Brix and J. H. Stevens, U. S. Navy. They will carry a full equipment of photographic material including mapping camera and special high power lenses for distance work.

Crews of the four Martin Bombers flown across the continent from San Diego to Wasbington.

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N. A. C. A. Publications

Reports

No. 143. Analysis of Stresses in German Airplanes, by Wilhelm Hoff. An exhaustive paper of 52 pp., with bibliography. 15c.

No. 136. Damping Coefficients due to Tail Surfaces in Aircraft, by Lynn Chu, of M. I. T., condensed and modified by Edward P. Warner. 14 pp. 5c.

Eighth Annual Report of the N. A. C. A., for 1922. Administrative Report, without Technical Reports. 52 pp.

No. 151. General Biplane Theory, by Max M. Munk, 47 pp. May be had for 10 cents from the Superintendent of Documents, Washington, D. C.

No. 156. The Altitude Effect on Air Speed Indicators-II, by H. N. Eaton and W. A. MacNair. A continuation of Report No. 110. 46 pp., with charts and illustrations. Available from Superintendent of Documents, Washington, D. C., at 10 cents.

No. 157. Nomenclature of Aeronautics. 59 pp., illustrated. Obtainable from the Superintendent of Documents, Washington, D. C., at 10 cents.

No. 158. Mathematical Equations for Heat Conduction in the Fins of Air-cooled Engines, by D. R. Harper 3rd and W. B. Brown. 31 pp. May be had from Superintendent of Public Documents, Washington, D. C., at 5 cents.

No. 159. Jet Propulsion for Airplanes, by Edgar Buckingham. 18 pp. Copies may be had at 5 cents from Superintendent of Public Documents, Government Printing Office, Washington, D. C.

No. 167. The Measurement of the Damping in Roll on a JN4h in Flight, by F. H. Norton. 6 pp. From Supt. Public Documents at 5 cents.

Technical Notes

No. 113. Report on the General Design of Commercial Aircraft, by Edw. P. Warner, of M. I. T. 19 mimeographed pages.

No. 120. A Preliminary Study of Airplane Performance, by F. H. Norton and W. G. Brown, of the N. A. C. A. laboratory. 7 pp. mimeographed, and 5 pp. illustrations.

No. 121. Further Information on the Laws of Fluid Resistance, by C. Wieselsberger. From Physikalische Zeitschrift. 8 mimeographed pp. and 3 pp. charts.

No. 122. The Determination of the Angles of Attack of Zero Lift and of Zero Moment, based on Munk's Integrals, by Max M. Munk, N. A. C. A. 9 mimeographed pp. and 2 pp. charts.

No. 123. An Optical Altitude Indicator for Night Landing, by John A. C. Warner, of Bureau of Standards. 5 mimeographed pp.; 2 pp. ills.

No. 124. Downwash of Airplane Wings, by Max M. Munk and Gunther Cario, 9 mimeographed pp. and 3 pp. of charts.

No. 125. Results of Experimental Flights at High Altitudes with Daimler, Benz and Maybach engines to Determine Mixture Formation and Heat Utilization of Fuel, by K. Kutzbach. A translation from Technische Berichte.

No. 126. Absolute Dimensions of Karman Vortex Motion, by Werner Heisenberg. Translation from Physikalische Zeitschrift.

No. 127. The Air Propeller, Its Strength and Correct Shape, by H. Dietsius. A translation from Technische Berichte. 9 mimeographed pp., 3 pp. of illustrations.

No. 128. Tests on an Airplane Model, AEG D-1 of the A. E. G. company. Conducted at Göttingen Model Testing Laboratory, by Max Munk and Wilhelm Molthan, from Technische Berichte. 4 pages of text and 26 pp. of tabulations and charts.

No. 129. Notes on Aerodynamic Forces on Airship Hulls, by B. L. Tuckerman. Mimeographed. 27 pp. text, 7 pp. ills.

No. 130. Model Supports and Their Effect on the Results of Wind Tunnel Tests, by David L. Bacon. 7 mimeographed pp. text and 6 pp. diagrams and charts.

No 131. Variation in the Number of Revolutions of Air Propellers, by W. Achenbach. From Technische Berichte. 7 mimeographed pp.

No.132. The Increase in Dimensions of Airplanes: Weight, Area, and Loading of Wings, by E. Everling. 27 pp. and 5 ills., mimeographed. Translated from Technische Berichte.

No. 133. Disturbing Effect of Free Hydrogen on Fuel Consumption in Internal Combustion Engines, by A. Riedler. From Technische Berichte. 5 pp. mimeographed.

No. 134. Standardization and Aerodynamics, by Wm. Knight, Prof. L. Prandtl, Prof. von Karman, Col. Ing. Costanzi, W. Margoulis, Lt.-Col. Ing. R. Verduzio, Dr. Ing. Richard Katzmayr, E. B. Wolff and Dr. A. F. Zahm. 98 pp. mimeographed. From Aerial Age of various issues.

No. 135. Measuring an Airplane's True Speed in Flight Testing, by W. G. Brown. 10 pp. mimeographed text; 4 pp. ills.

No. 136. Is There Any Available Source of Heat Energy Lighter than Gasoline?, by P. Meyer. From Technische Berichte. 6 pp. mimeographed.

No. 137. Experiments with Fabrics for Covering Airplane Wings, by A. Pröll. Translated by N. A. C. A. from Technische Berichte. 18 pp. mimeographed text; 17 pp. charts.

No. 138. Determination of the Value of Wood for Structural Purposes. A communication from the Material Testing Laboratory of the Royal Technical High School at Stuttgart. By Richard Baumann. Translated from Technische Berichte. 10 pp. mimeographed text; 3 pp. photostats and charts.

No. 139. Influence of Ribs on Strength of Spars, by L. Ballenstedt. From Technische Berichte. 18 pp. mimeographed text; 6 pp. charts.

No. 140. General Theory of Stresses in Rigid Airship ZR-1, by W. Watters Pagon. 43 pp. mimeographed text; 3 pp. diagrams.

No. 141. Experiments with a Built-in or Fuselage Radiator, by C. Wieselsberger. Translated from Technische Berichte. 15 pp. mimeographed text and charts.

No. 142. Adaptation of Aeronautical Engines to High Altitude Flying, by K. Kutzbach. Translated from Technische Berichte. 30 pp. mimeographed text and 15 pp. diagrams.

List of Navy Publications

Following is a list of Navy publications on aeronautics, continuing the series of catalogs and available government publications already printed in Aerial Age.

Technical Orders

1 Care of Aircraft Propellers During Storage and Use.
2 Operating Temperatures Aviation Engines.
3 Wright Engines.
4 Geared Liberty Engines.
5 Dixie Magneto Switches, Aero Type, as Installed with Magnetos. Care to be Observed in Operation.
6 Breather Holes in Pontoon Handhold Plates.
7 Joints made with Casein Glue.
8 Inspection of Bonding.
9 Longitudinal Dihedral of Type F-5-L Boat Seaplanes.
10 Thread for Sewing of Seams in Airplane Fabric.
11 Use of Commercial Motor Gasoline (low test) in Aircraft Engines in Emergency.
12 Notes on Flexible Gasoline Pipe Connections.
13 Care in Handling of Wing Panels to Prevent Breaking of Air Speed Meter Tubing.
14 Flying of the DH-4 Airplanes.
15 Model VE-7 Airplane. Change No. 81 Elevator Control Leads.
16 Cancelled.
17 Installation of Leads from Pressure Fire Extinguishers.
18 Change in Standard Propeller Design for F-5-L and PT Seaplanes.
19 Venting Gravity Gasoline Tanks.
20 Oil Pressure Gage Connections.
21 Liberty Engine Gear Inspection Hole.
22 Installation of Screen Over Outlet Fuel Line.
23 Use of Aluminum and Aluminum Alloys in Fuel Systems for Airplanes.

Aeronautical Specifications

1—B. Cellulose acetate dope.
2—A. Cellulose nitrate dope.
3—A. Spar varnish.
4—B. Naval gray enamel.
5. Black enamel.
6—A. Dope solvent.
7—A. Wire and cable enamel.
8. (Withdrawn.)
9—A. Wood filler.
10. (Withdrawn.)
11—B. Hide glue certified for use in airplane construction.
12. Linen for airplane covering.
13. Mercerized-cotton airplane fabric (grade A).
14—C. Rubberized fabric.
15—C. Water-resistant panels or plywood (grades A and B).
16. (Withdrawn.)
17—A. Chemical compositions of standard aeronautical steels.
18—A. Tolerances on steel bars, sheets, tubes, wires, and cables.
19—A. Cold-drawn or cold-rolled carbon-steel bars.
20—A. Medium carbon-steel bars and billets (70,000 TS).
21—B. Medium carbon-steel bars and billets (80,000 TS).
22. Half-hard carbon-steel bars and billets (80,000 TS).
23. (Withdrawn.)
24. Alloy-steel bars and billets (100,-000 TS).
25—A. Alloy-steel bars and billets (125,-000 TS).
26—A. Alloy-steel bars and billets (150,-

000 TS).
27—A. Alloy-steel bars and billets (175,-000 TS).
28—A. Alloy-steel bars and billets (200,-000 TS).
29—A. Alloy-steel bars and billets (225,-000 TS).
30—A. Alloy-steel bars and billets for casehardening (130,000 TS).
31—A. Alloy-steel bars and billets for casehardening (160,000 TS).
32—A. Alloy-steel bars and billets for casehardening (180,000 TS).
33. (Withdrawn.)
34. (Withdrawn.)
35—B. Seamless copper tubes.
36. (Withdrawn.)
37—A. Sheet aluminum (99 per cent).
38—A. Sheet aluminum (98 per cent).
39—A. Zinc coatings for metal parts.
40—A. Allowance defects in wood seaplane parts.
41. The determination of specific gravity in wood.
42. The determination of moisture content in wood.
43—A. Certified casein glue.
44—A. Airship dope.
45. Airship dope thinner and solvent.
46. Bevel washers, round and square.
47. Naval brass alloy bars.
48—B. Aircraft insignia colors.
49. Aircraft insignia and marking.
50—A. Aircraft wire, strand and cable.
51—A. Alloy-steel, sheet or strip (100,000 TS).
52. (Withdrawn.)
53—B. Aluminum-alloy sheet.
54—A. Aluminum-alloy bars.
55. Aluminum tubing.
56. Mild carbon-steel seamless tubes (low tensile strength).
57—B. Welded steel tubes.
58—B. Mild carbon-steel seamless tubes.
59—A. Medium carbon-steel seamless tubes.
60—A. Turnbuckles.
61. Streamline wire stay rods.
62—B. Universal terminals for streamline and swaged wire.
63—A. Clevis pins.
64. (Withdrawn.)
65. Sheaves for control cable (being prepared).
66—A. Spliced and laminated spruce wing beams.
67—A. Ferrules and thimbles.
68. Rigid terminals for streamline and swaged wire.
69. Shackles.
70. Medium carbon-steel sheet or strip.
71—B. Cold-rolled mild carbon-steel strips.
72—A. Soft carbon-steel sheet or strip.
73. (Withdrawn.)
74. Mild carbon-vanadium steel sheet or strip.
75—B. Powdered aluminum.
76. Light linen thread.
77. Heavy linen thread.
78. Silk thread (grade A).
79—A. Silk thread (size C).
80—C. Airplane spruce.
81—A. Airplane ash.
82. White pine, sugar pine, and western white pine for aircraft construction.
83. Cotton hull sheeting.
84. Cotton pontoon sheeting.
85. Casein for use in certified casein glue.
86—A. Wrapped terminal for nonflexible 19-strand steel cable.
87—A. Spliced terminal for flexible and extra-flexible cable.
88. (Withdrawn.)
89—A. Heat treatment of brazed joints.
90. Brazed joints.
91—A. Brass for brazing.
92. (Withdrawn.)
93. (Withdrawn.)
94. Sandbag duck.
95—A. Aircraft hexagon-head bolts (for bodies and wings, not engines).
96. (Withdrawn.)
97. Aircraft hexagon nuts.
98. (Withdrawn.)
99. (Withdrawn.)
100. (Withdrawn; superseded by SD 24a.)
101. Parachute silk.
102—B. Elastic cord for shock absorbers.
103. Terminal eye.
104. (Withdrawn.)
105. Aluminum wing enamel.
106. (Withdrawn.)
107. (Withdrawn.)
108. (Withdrawn.)
109. (Withdrawn.)
110. (Withdrawn.)
111. (Withdrawn.)
112. Terminal for round steel wire.
113—A. Dirigible and kite balloon cloth.
114—A. Round swaged-wire stay rods.
115—A. Alloy-steel seamless tubes.
116—A. Soldering flux.
117. Hemp rope for balloon riggings.
118. Airplane propellers.
119. Airplane propellers, large diameter.
120. Kiln-drying process for airplane-propeller stock.
121. Woods used in airplane-propeller construction.
122. Walnut lumber for airplane propellers.
123. Mahogany lumber for airplane propellers.
124. Tanguile mahogany for airplane propellers.
125. Cherry lumber for airplane propellers.
126. Oak lumber for airplane propellers.
127. Birch lumber for airplane propellers.
128. Treating aluminum tanks to remove welding flux.
129. Maple lumber for airplane propellers.
130. Soft brass for tipping seaplane propellers.
131. Aluminum fuel tanks.
132. General specification for aeronautical radiators.
133. Naval yellow enamel.
134. Crates for airplanes.
135. Crates for engines.
136. Linen thread.

Miscellaneous Publications

Naval Aeronautic Organization—Fiscal year 1923. Syllabus for The Training of Naval Aviation Observers. Syllabus for the training of Naval Aviators and Naval Aviation Pilots—Airplane.

Technical Notes

Bureau of Aeronautics Technical Notes are now in the process of revision and list of same will be issued upon completion of this revision.

Army Air Service Information Circulars

Following are the latest additions to the list of Air Service Information Circulars. Those marked with an asterisk (*) may be had by money order from the Superintendent of Documents, Washington, D. C. For the balance, apply to the Chief of Air Service, Washington, D. C.

303. Addendum to circular *303 on Discussion of Airplane Tires and Wheels.
* 340. Statistics Compiled from Reports on Crashes in the U. S. Army Air Service during the calendar years 1918-1921, inclusive, and Results of Physical Examinations for Flying during calendar years 1920 and 1921. 5c
341. Description of McCook Field 5-Foot Wind Tunnel.
354. Variation in Performance of a Hispano-Suiza (Model E) Engine with Degree of Throttle Opening.
355. Report of Wind Tunnel Test of DH4b model.
357. Report on Test of Bijur Ignition End Starter for Airplane Engines.
360. Report of Static Test of the Junker L6 Monoplane.
363. Heat Treating Bath Composed of Sodium Chloride, Sodium Carbonate and Sodium Cyanide.
364. Adaptability of the Hyde Welding Process to Steel Engine Cylinder Construction.
366. Emergency Landings from Low Altitudes—Minimum Altitudes Required to Turn Back into Field in Case of Engine Failure after Take-off.
367. Wind Tunnel Test of the Junker L6 Monoplane.
368. Tests of Back Suction and Air-bleed Type Mixture Controls in Flight.
369. The Bellows (Sylphon) Fuel Pump for Liberty 12 and Wright H Engines.
370. Test of a Zenith Carburetor, Model U. S. 52, Fitted with "Plain Tube" and Britton Type Discharge Nozzles.
371. The Physical Properties of Manganese Bronze.
372. Flight Test of an Anti-knock Injector.
373. Test of Curtiss 8 Cyl. Model OX5 Engine rated at 90 h. p. at 1400 r. p. m.
374. Interior Corrosion of Steel Struts and Its Prevention.
375. Curves for Estimating the Fuel Consumption of an Aeronautic Engine on the Basis of Piston Displacement and R. P. M.
376. Methods of making Aluminum Bronze Castings.
383. The Effect of Doped Fuels on the Fuel System, Part II.
384. Effect of Climate on Standard Airplane Wing Coverings.
386. Performance Test of U. S. Mail DHM2.
390. Sediment Deposit in Carburetors.
385 Investigation of Copper-Silicon-Aluminum Alloys with and without Manganese. 27 pp. text, charts and ills.
294 The Distribution of Load Among Spars in Multi-spar Construction of Airplane Wings. 10 pp. ills.
395 Comparison of Column Formulas. 4 pp. text and chart.
397 Bamberg Speed Measuring Station.

401 Investigation of the Effects on Cylinder Performance of Variation of Position and Number of Spark Plugs.
392 Modified Mark I Airplane Flare 2 pp. text.; ills.
393 Physical and Metallographic Properties of Copper-Zinc-Aluminum Alloys Containing Small Amounts of Magnesium. 5 pp. text.; ills.
402 Aircraft Development Since the Armistice. Airplanes, Armament, Engines, Equipment. 34 pp., illustrated.

N. A. C. A.

Report No. 162 Complete Study of the Longitudinal Oscillation of a VE-7 Airplane, by F. H. Norton and W. G. Brown 5 pp. illust.
387— Airplane Wing Fittings. 20 pp., ill.
389— Pyrotechnic Projector and Ammunition Submitted by Ordnance Dept. for Test

Aerostation Series

390— Characteristics of Streamline Forms and Design Data for Airship Hulls.
391— Report of Inspection Trip to France, Italy, Germany, Holland and England, By Brig-Gen. Wm. Mitchell, Lt. H. C. Bissell and Alfred Verville.

Information Circulars (Aerostation)

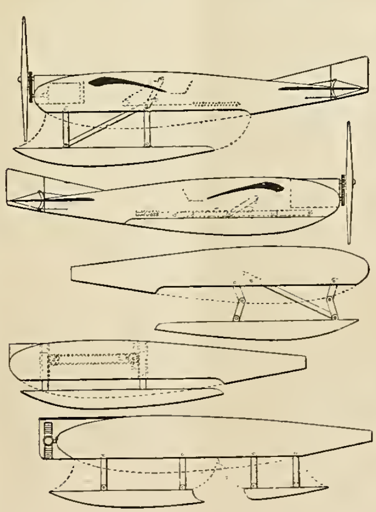
1 Tests of Balloon Fabric
2 Extract from Report of Bureau of Standards Regarding the Recommendation for Filling Balloons
3 Table for Finding the Ascensional Force of Gases
4 Notes Concerning Hydrogen Cylinders
5 Net Tensions
7 Stevens Parachute Pack
8 Aids for Young Officers Commanding Companies.
9 Discharge of Gas from Pipes
10 French Practice in Dirigible Construction
11 Observations from Captive Balloons
12 Gunnery Projectiles
13 Effect of Hydrogen Impurities on Airship Fabrics
Effect of Gases and Chemicals on Balloon Fabrics
14 German Captive Balloon Organization
15 Parachute Tests
16 Balloon Observation in Connection with Artillery
17 Protection of Kite Balloons from Lightning
18 Theory of Ballooning
19 Report of Free Balloon Trip of Kite Balloon
20 Service Instructions for the Balloon Liaison Officers in the Course of an Attack
21 The Air Service in Mobile Warfare
22 Dilatable Type Balloon
23 Useful Notes for Riggers
24 Balloon Information from Italian Army
25 Operations of Allied Balloons in The St. Mihiel Offensive
26 Instructions for the Use of Portable Anemometers
27 The Lift of Hydrogen
28 Report on the Causes and Prevention of Fires in Balloons
29 Fireproofing Parachutes
30 Topography and Perspective for Balloon Officers
38 Electrification of Observation Balloons
39 Characteristics of Streamline Forms and Design Data for Airship Hulls.
40 Comparison of the Air Resistance of the Airship Models C1, C2, RO, SR1 and UB2A.
133 Announcement: Inauguration of Air Service Information Circular (L/A)
135 N. C. L. Observation Balloon Winch
137 General Notes on Organization and Tactics Indispensable to the Balloon Observer
138 Synopsis of General Subjects for Instruction of Balloon Observers.
142 Artillery Notes for Observers
143 Artillery Lectures
144 German Captive Balloon Organization
145 British Balloon School and Description of Protecting Cover for Balloon Rigging
146 Memo regarding Leakage of Hydrogen from Balloons
147 Danger Cone Clamp
148 Artillery Adjustment and Dispersion of Fire
150 Elementary Notes on Artillery
151 Tactics Employed by German Airplanes in Attacking Balloons
152 Instructions for Balloon Group Commanders and Instructions Relative to Balloon Service Record Cards
153 Common Mistakes of Inexperienced Company Commanders
154 Telephone Lines and Equipment for Balloon Companies
155 Information for Maneuvering Officers
156 Translation of German Documents on "Notes of the Balloonist".
157 Hydrogen for Military Purposes.

The Smith Retractible Chassis

REX SMITH is dead. Smith, it will be remembered, was a patent attorney of talent and a man of most lovable disposition who drifted into aeronautics for the love of the "game". Pioneers will recall his early efforts at College Park and the launching of the career of "Tony" Jannus, the intrepid pilot and two-cycle engine wizard. Paul Peck, another intrepid pilot, received his early training under Rex Smith. At the time of his death "Rex", as he was known to all his friends, was employed as an attorney in the Army Air Service. C. C. Hines, another patent attorney of Washington, a close friend and former business associate of Smith's has been taking care of the Smith patent interests.

Rexford M. Smith is claimed, in some quarters, to be the pioneer in the retractible chassis field. The statements of the Army Air Service* as to the great value of such a device, the Martin conspiracy suit, and the various claimants for folding honors, add special interest to the Smith patent.

The leading feature of the Smith invention resides in the provision of



a nacelle which is composed of the airplane's body proper and a supporting base, the parts being so divided and combined that when brought together they form a streamline body, offering the minimum of head resistance.

The supporting base—float or running gear—as a whole is included within the confines or outer contour of the nacelle or fuselage, the two sections forming complimentary portions of each other. The means for spreading the two sections apart and drawing them together, and the means for counter-balancing the supporting section of the nacelle and for locking the sections in fixed relation to each other are merely incidentals, for which any suitable mechanism may be provided.

The patent claims that the system is applicable to aircraft of either heavier or lighter-than-air type, whether designed for land or water use.

(Concluded on page 346)

The Nordman Sailplane

THE sailplane designed and constructed by H. J. Nordman of Flushing, L. I., promises to be the most successful in America. Trial flights made during the first week of June showed the machine to be well balanced, manoeuverable and entirely airworthy. Real "air sailing" was not possible due to the almost absolute calm air in which glides were made. The first attempt at gliding was made at daybreak, from an elevation of about 150 feet at the golf course of the Belleclaire Country Club, Bayside. Altho not a breeze was stirring, glides of about 1000 feet were made. Later attempts were made one afternoon, but there was not enough breeze to expect soaring flights to be made.

Mr. Nordman is known by many of the readers of AERIAL AGE for his instructive articles on gliders and bird flight which have appeared on the "Soaring Flight" page. Mr. Nordman has gathered extensive data on this subject and his successful design is the result of his studies and experiments covering a period of ten years. He is one of the charter members of the Long Island Flight Association which was organized more than a year ago for the purpose of investigating Soaring Flight. Several members of the club were witnesses of the flights, including George Page, Arthur O. Heinrich, H. B. Shields, R. C. Greenwood, Wm. Schultz and G. F. McLaughlin. The machine was flown by Mr. Heinrich, who is an experienced pilot of wide fame. Heinrich's masterful handling of the plane drew considerable praise from those on hand to see the machine in action.

Brief specifications of the Nordman Sailplane are as follows:

Wing Span ....40 feet
Wing Chord ....54 inches

The Nordman Sailplane in flight

Wing Area ......188 square feet
Total Weight ....200 pounds

The body is of rectangular section, built up with four longerons spaced with spruce struts. Linen covering is used. In the forward part of the body are the pilot's seat, control stick and foot bar, for the rudder, as used in the conventional modern airplane. Light weight has been secured in all control members by a careful calculation of the stresses to be imposed upon them; the parts being designed to be merely strong enough for the purpose with a normal allowance for safety. As the air loads on the control surfaces is relatively small, the control stick required is surprisingly light.

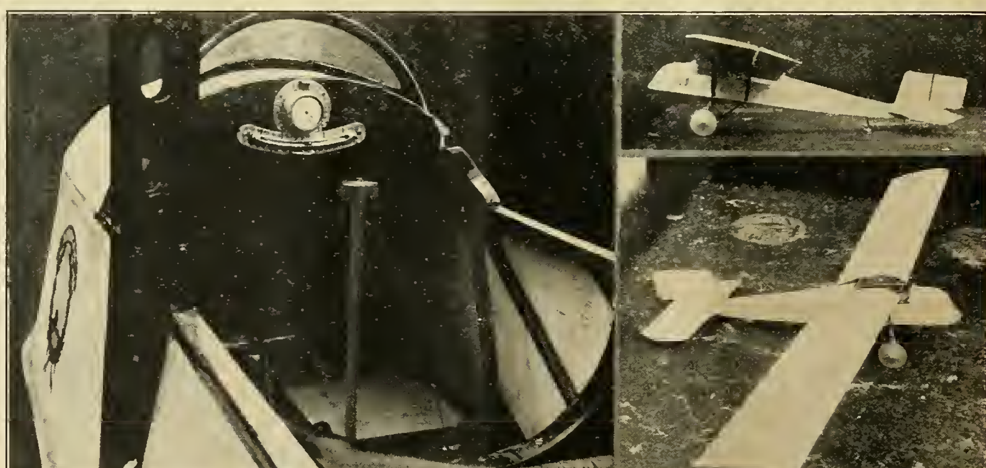
A quick release catch is fixed at the forward part of the machine. In the take-off a tow line is attached at the tow-catch and when the pilot wishes to release the machine he pulls the release wire at the dashboard, the release catch holding the rope opens and allows the line to drop clear.

The method of starting has proven to be very effective. When all is in readiness for flight, the tow line is attached and a group of men are assigned to handle it. This tow line consists of about fifty feet of exerciser elastic cord such as used on the landing gear of aeroplanes. Several men hold the machine while those with the line walk forward, stretching the rubber to two or three times its normal length depending upon the desired initial speed for the take-off. At a signal from the pilot, those holding the machine release it and at the same time the group handling the line, run forward. This results in a rapid climb and when the pilot feels the line loses its effectiveness he pulls the catch wire to drop the rope. At this time the machine has ascended to some thirty or forty feet above the starting point. Under favorable wind conditions, soaring flight is then easily possible. Where there is no wind, the pilot simply heads the machine down and glides to the ground about one thousand feet away.

The wings are of constant chord but the thickness varies. A thick curve next to the body is tapered to a fairly flat thin curve at the tip. The wing section is one developed by Mr. Nordman and combines one of the U. S. A. Curves and the Sloane Curve. Much valuable data in this respect was secured from the Smithsonian Institution and the National Advisory Committee for Aeronautics at Washington, D. C.

Complete erection of the wings on the body requires less than half an hour. The monoplane surfaces are braced from below with streamline spruce struts with drift wires between. The wings are built up with lightened spars and a single ply veneer nose. Ribs 18" apart. The trailing edge is of steel piano wire. Covering of doped linen.

Tail surfaces are thick at the roots and tapered to a thin outer edge. The stabilizer has a span of 9 feet 6 inches.

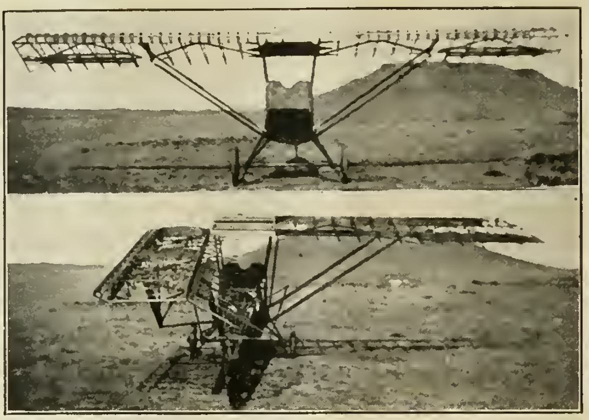


The Nordman Sailplane. The large view shows the cockpit interior, with clock and inclinometer mounted on the dashboard. The conventional type of rudder bar and stick control are also visible.

A conventional type of rubber-sprung shock absorber tail skid is used.

Two twenty-inch rubber tired wheels are used on the chassis. The wheels are built of thin veneer, using a standard hub and rim. The chassis consists of a pair of vertical spruce struts with forked lower ends which receive the axle. The axle is attached with exerciser cord. Steel tubes space the lower ends of chassis struts and bracing is secured with diagonal wires and steel tube rear brace struts to the body.

The entire plane is finished in aluminum. In flight it resembles a huge soaring bird. On the afternoon of June 6th, flights were made for several motion picture representatives and reporters from the various newspapers. On one flight the "movie" men assembled near the base of the hill from which the flight started. When "Art" Heinrich got well up into the air the camera-men started to move their machines to get closer to the plane. Seeing this, Art called out "stay right where you are, fellows, I'll come right over you." He made a bank and turned toward the army of photographers, clearing their heads by twenty feet. As a result of his ability to handle the machine, excellent photos of the machine in flight were obtained by all the moving picture cameramen. The voice of the pilot in flight proved a source of amazement to those below and most of the amateur photographers were so intensely interested they forgot about taking pictures.



The "Dakota Girl" a Ford motored monoplane being constructed by C. W. Roberts, Carson, N. D. Span 25 feet, chord 4 feet, length 18 ft. 6 in. Propeller 5 ft. 8 in. Diameter 6 ft. 6 in. fitted.

The Junior Branch of the N. A. A.

The National Aeronautic Association has not only aroused interest among business-men, but even among boys. The Episcopal Academy Junior Branch of the Philadelphia Chapter, National Aeronautic Association of the U. S. A., formed with the help of C. T. Ludington in Philadelphia, is now well under way. All the members are enthusiastic and a charter has been applied for.

Mr. Ludington has given the boys a very interesting talk on his European air travels; the Naval Aircraft Factory at League Island has been inspected, and, best of all, a trip to Lakehurst and to Pine Valley was recently taken. At Lakehurst the boys were thrilled by the size of the ZR-1, and at Pine Valley the majority of the members had their first flight.

The officers of the Junior Branch are: Honorary Chairman, Earlham Bryant, ex-equipment officer of the 20th Squadron, R. A. F. a master at the school, and General Manager, Alfred J. Ostheimer Third. The temporary office, until a club-room can be secured at the school, is at young Ostheimer's home, 2204 De Lancey St., Philadelphia, Pa.

(*Continued from page* 322)

what is to come."

This flight brings home to the business men of this country the fact that they have practically ignored the possibilities of the airplane as the most rapid means of transportation now available. In England, France, Germany and The Netherlands, the aerial freight business is in a flourishing condition. The Army Air Service has already demonstrated the commercial possibilities of the airplane by shipping spare parts for airplanes and engines, clothing, etc., by air in a fraction of the time possible by rail or boat.

(*Continued from page* 343)

The claims of the Smith patent, 1,166,488, application field Dec. 27, 1912, issued Jan. 4, 1916, cover the following points:

A closed nacelle having a relatively movable supporting base portion forming a complementary part thereof and movable up and down with relation thereto; means for adjusting the undercarriage upwardly against the bottom and within the stream-line; an undercarriage comprising fore and aft members; a closed stream-line nacelle having a separable supporting bottom section movable up and down relative to upper section and adapted to be housed within the stream-line of the nacelle; means for raising and lowering; undercarriage shaped to provide a lifting surface while in flight and a surface against which the air acts to press the carriage upward into the body of the nacelle; means for spreading sections apart and drawing them together and means on the upper section for counterbalancing the weight of the lower section; and other.

The idea of alighting gear which could be drawn up is not new. Penaud's patent of 1872 has twin alighting gears which are foldable, but it is claimed by friends of Rex Smith that he was the first to conceive the idea of folding the alighting gear as one unit into the fuselage. One will also recall the OWL —over water or land—hydroairplane built by Curtiss for the Navy when Captain W. I. Chambers was at the head of marine aeronautics—was it not in 1912? If memory serves, this had wheels which folded into the float when used on water.

Nothing ever seems to be new.

New Farman Undercarriage

The most important wood for aircraft construction is Picea rubens, though an excellent substitute is Chamaecyparis lawsoniana, which is slightly heavier. Other woods which play their parts are P. monticola and P. lambertiana, as well as Tsuga heterophylla.

In the old days when pilots had to actually fly we didn't know much about A. amabilis or Tilia americana or even Acer saccharum but now that science has applied its formulae and we have to contend with eight plus per cent fires and all sorts of other things like DH4b's and Martin transmissions, monococci and such, decays in woods and discolorations play their part, according to a new bulletin No. 1128 of the U. S. Department of Agriculture, by J. S. Boyce, pathologist, which can be obtained, including the colored plates, which are a rarely good example of the printer's art, from the Superintendent of Public Documents, Washington, D. C., at 20 cents. Here is a pamphlet of 49 pages of text and colored plates which will make any airplane inspector sit up and take notice. It's a worth-while book.

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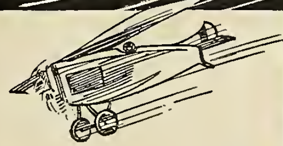

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First come first served.

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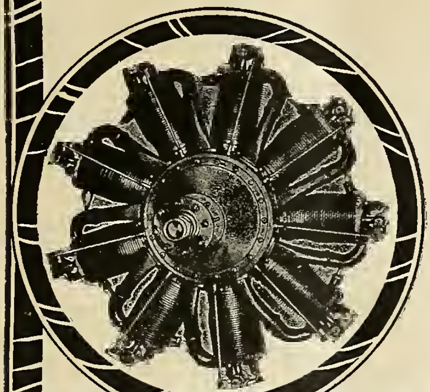

After these motors are sold there will be no more. We have purchased the last lot from the government together with a large quantity of spare parts. Every motor is thoroughly tested and checked by our Aeroplane Engineers before leaving Fairfield Depot, Ohio. Every motor is perfect with the exception of a test run.

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High powered motors made by De Dion Bouton, Peugot and other foreign manufacturers.
A quantity of spare parts for these motors are on hand and can be obtained in 24 hours.

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Great Sacrifice SALE Everything Must Go!

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LE RHONE MOTORS—80 horsepower..... 47.50
New packed in original crates; complete with magneto, carburetor and tool kit and new propeller.

LE RHONE—80 horsepower................$17.50
Used, first class condition; complete with magneto, carburetor and new propeller.

NEW BERLING MAGNETOS 7.50

NEW ZENITH CARBURETORS 4.75

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PROPELLERS FOR OX5 MOTORS

MAKE	WOOD	COPPER TIPPED	TYPE	DIAMETER	PITCH	PRICE
AMERICAN	Oak	"	Toothpick	8'4"	5'	$3.00
FLOTTORP	Birch	"	Toothpick	8'4"	5'	3.00
FLOTTORP	Birch	"	D-5000	8'	5'3"	3.00
US Propeller	Birch	"	Toothpick	8'4"	5'	3.00
WEOTMORE	Birch	"	Toothpick	8'4"	5'	3.00
MAHEW Co.	Birch	"	Toothpick	8'4"	5'	3.00
PACKARD	Oak	"	Toothpick	8'4"	5'	3.00
STARR	Oak	"	Toothpick	8'4"	5'	3.00
STARR	Oak	"	D-5000	8'4"	5'3"	3.00
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Note: Lots of 25..............$2.00 Lota of 100 $1.50

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Sets complete New.............$12.00
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Bearings OX-5, new
Front Main upper & lower 25c each
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Patent Attorney
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WANTED—Position as pilot, 500 hours. Two years on French front. All types. Carrying passengers every season since war. Address Walter J. Shaffer, Dauphin, Pa.

FOR SALE—Complete OX5 motor, 90 H.P. New pistons, rings, pins and valve action. Tuned up ready to run. W. W. Keatts, Sheldon, Ill.

FOR SALE—Aeroplane, single seater, and 2 Roberts motors, 50 and 60 H.P. in perfect condition. O. A. Solbrig, 707 West 7th St., Davenport, Iowa.

SERVICES GIVEN by young man interested in aviation for flying instructions. Willing to travel and make jumps. Lewis M. Brown, Castile, N. Y.

PHOTOGRAPHS—Twelve 5 x 7 Clear interesting large views, aeroplanes flying stunting. Hydroplanes included. $1.50; Twelve crashes, wrecks, size 5 x 7 $1.50. Wm. J. Lynch, 5206 Bishop St., Chicago, Ill.

MAKE ME AN OFFER on my Bleriot monoplane. H. A. Steppuhn, 2533 Avenue H, Council Bluffs, Iowa.

FOR SALE—OX5 Standard, new, on field. Flies perfectly. Would consider car on trade. Reason for selling eyesight bad. Have extra spare parts. M. L. Powell, Stanberry, Mo.

NEW HISPANO STANDARDS $1350.00. Also one or two used Canucks at $500.00 in flying condition. Write or wire Wilber Larrabee, Groveland Avenue, Minneapolis, Minn.

FOR SALE—Flying boat Albatross (HS1L) in good condition. Price $2500.00. Write Brown, care Bunn Bros., 165 W. 45th St., New York City.

NEW THREE PASSENGER STANDARD J1 for sale— 180 H. P. Mercedes motor. Rigged thoroughly tested in actual flight and ready for use at any time. Price $2000.00. Write for full description and photographs. Also have two 160 H. P. Beardmores for sale, $200.00. Lyle Hostetter, Frankford, Mo.

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AVRO FOR SALE—New 140 Clerget motor. Never flown since removed from crates. $800.00 to quick buyer or will trade. Rowe Fliers, Binghamton, N. Y.

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FOR SALE—K-6 Oriole motor forty hours service. Complete 2 mags, carburetor, self-starter and propeller hub. First cashier's check for $1000.00 gets it. Also 1 Oriole fuselage, 1 set wings and ailerons, 1 set tail surfaces, all complete, need new covering. 1 radiator. All the above in excellent condition. First cashier's check for $250.00 gets these. C. H. Siebenbausen, Box 144, York, S. C.

WANTED—M.F. flying boat, OXX6 or Hispano motor, must be practically new, absolutely perfect condition. J. G. Hall, 81 Nassau Blvd., Garden City, Long Island.

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